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Ceramic Interconnect and Ceramic Microsystems Technology (CICMT)
Conference and Exhibition Program

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Ceramics Interconnect Technology
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Advancing Microelectronics

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March/April 2005 - Advancing Microelectronics 1
This is an active time for IMAPS around the globe. Depending on when you copy this AM was delivered, we have just completed the first Device Packaging conference, or are about to. Upcoming there is the Ceramics conference in Baltimore (more on that below), the ICEP conference in Tokyo, and several Advanced Technology Workshops. Our topics span the globe in interest as well as in markets. Our industry covers the many facets of electronics packaging; have you ever thought of how many ways our members make connections? When you have a quiet moment, give it some thought and you’ll be surprised; consider not only the physical connections in our products, but the personal connections that enable the synergy that IMAPS strives for. That’s why these meetings are important to us all “in the long run” as we say in the US.

Ceramics amaze me. They are a versatile technology, with numerous uses in electronics packaging. RF, high temperature applications; LTCC design versatility; consumer and automotive applications; both cost sensitive and leading edge applications - they’re all there. I’m also amazed at what isn’t there - and that is a general recognition of today’s ceramic technology as being much broader than the thin film heritage that ceramics came out of (literally?). Process automation and photo-imaging technology have laid the groundwork for such broadening, and will continue to make ceramics progressively more amenable to a larger part of traditional “mainstream” electronics packaging applications. We saw some good examples at our recent Symposium in Long Beach. The program for the Ceramics conference - formally renamed as the ACerS/IMAPS 1st International Conference and Exhibition on Ceramic Interconnect and Ceramic Microsystems Technologies (CICMT) - also gives a pretty good idea of how ceramics have spread through and beyond the electronics packaging arena. The scope of the conference has been expanded to explicitly include microsystems, recognizing the higher role ceramics now play outside of the “jellybean” components industry. There are even six notable keynote speakers, covering materials, business, and applications aspects pertaining to ceramic technologies and the microsystems made possible by them. Sam, Dave and their team have put together a great conference that will showcase the advances this technology has made possible. It should be an amazing conference!

I mentioned the 2005 ICEP conference, the International Conference on Electronics Packaging, being organized by our IMAPS colleagues in Japan. It is being held in Tokyo from April 13-15. At this writing, the program has not yet been announced, but it will be available at the web site, http://www.iecp.or.jp/icep/index.html, or go to the calendar at our web site, www.imaps.org, and you will find a link. Dr. Denda has graciously invited me to speak on our society, and I have gratefully accepted. If past conferences are an indication, you will have much to look forward to at the conference, and in the hospitality of our hosts. I am very much looking forward to it, and I hope you will consider attending also.

A word is in order about our increasingly intertwined society. Just as the economic market we operate in has become progressively more intertwined across the globe, our organizational activities are challenged by the necessity to become more global. IMAPS as an organization needs to strengthen its global presence and coordination to lower the barriers in advancing the many aspects of electronics packaging. There are a number of obstacles to progress in unification, globalization or whatever term we choose to use; some of these are our own perceptions and some are differences in how we conduct our functions in different parts of the world. The geographical blocks of our organization operate differently at our functions (chapter meetings, symposia and the like), in governance of the blocks, in how we manage financial aspects, and in the legal requirements of the region. There is no clear answer as to how IMAPS should look when truly unified, because there is no uniform idea of what unification is. In my personal view, I am starting to see that this is more of a journey than a destination - more of a process than an end point. On a practical scale, this means we need to address the obstacles one group at a time and we can expect some conflicts. It also means we must continue to identify and address these obstacles, as they are what impede our common goal. That is what our members expect - the ability to interact on many levels (business, technical, and personal). I feel that our society’s leaders around the globe have the same goals in mind; our task is to find ways to achieve a more global IMAPS so we all win. I wouldn’t be in this job if I didn’t think it was worth it!

My best wishes to all,
Bruce Romenesko
2005 President

UPCOMING IMAPS EVENTS

International Conference on Device Packaging
March 13-16, 2005
Scottsdale, AZ
(co-located with GBC Winter Meeting)

GBC Winter 2005 Meeting
March 16-17, 2005
Scottsdale, AZ
(co-located with Device Packaging)

International Conference on Ceramic Interconnect and Ceramic Microsystems Technologies
April 10-13, 2005
Baltimore, MD
Co-sponsored by IMAPS and ACerS

China Trade Mission: Exploring Business Opportunities for Microelectronics
in the cities of Beijing, Shenyang, Ningbo, and Shanghai
April 14-25, 2005
China (4 cities)
Co-sponsored by IMAPS, GBC and CMSigma LLC

TW and Tabletop Exhibition on Military, Aerospace, Space and Homeland Security: Packaging Issues and Applications
May 3-5, 2005
Rancho Cordova, CA
*Exhibitors contact abell@imaps.org

Topical Workshop and Exhibition on Flip Chip Technology
June 20-23, 2005
Austin, TX
*Exhibitors contact abell@imaps.org

IMAPS 2005 - 38th International Symposium on Microelectronics
September 25-29, 2005
Philadelphia, PA
*Exhibitors contact abell@imaps.org

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Networking - “no man is an island”

Reduced time to market, and needs for making products and ideas ready for production in a short time frame, call for engineers able to handle many different tasks and mastering many different disciplines.

With even leaner facilities, most companies do not have the luxury to employ large groups who will have the necessary time to run technology projects and learn from scratch.

Therefore networking becomes so important. We can meet and learn from colleagues working with the same issues. In spite of competition, common challenges can be discussed. Experience with materials, equipment and suppliers can be shared.

A forum of individuals and specialists you meet in person is in this respect much more efficient than written communication with people you barely know.

“No man is an Island” is a famous poem, but also a well used quote - most likely used in most of our countries in our local language. Originally composed in 1624 by the English poet John Donne, the first couple of lines of this poem are, ‘No man is an Island, entire of itself; every man is a piece of the Continent - a part of the main…..’

It is so true.

IMAPS offers a great opportunity, because the many conferences and workshops form the frame for the IMAPS family network. Here we will have a chance to meet life-long friends and make contacts important for our life. Many of us have experienced this when facing turbulent times - maybe leaving a job as an employee and starting a business on our own. Also here the strength of a good network has shown its values.

However it is not enough that a few of us knows this, also the person who pays your bills, the conference fees and the flight tickets should know the importance of this. As one of our IMAPS-Nordic members expressed it, he did not really care too much about the technical programme of the conference, but what mattered was the networking possibilities offered, like time enough in the breaks, time for the exhibition, the social lunches, dinner and reception for the contacts to take place.

So do experience it yourself. Do pay your membership fee, do come to our events. IMAPS is not only dissemination of knowledge, but IMAPS is also networking and support.

Finally I will encourage you to come to our European Microelectronics Conference and Exhibition June 12-15.

It takes place in the historical town Brugge in Belgium. Brugge is famous for its picturesque, medieval city center, its lively atmosphere and its canals.

A wonderful place to come - as delegate or exhibitor. The conference will as normal combine an excellent technical programme with excellent networking and sightseeing possibilities at this wonderful time of the year.

Please read more at www.imapsbrugge.be or www.empc2005.be

See you in Brugge!
Søren Nørlyng
noerlyng@micronsult.dk

From the Executive Director
Looking Forward

As you read this column, spring is quickly approaching (at least in the northern hemisphere), and perhaps the IMAPS Symposium in Philadelphia this September is not the number one item on your mind. Well, OK, we’ll settle for being number two!

Oddly enough, it’s January here in Washington, DC, as I write this column, but that’s the nature of the seriousness of the planning that goes into bringing you the finest event in the microelectronics and packaging industry. Through the leadership of Andy Stranjord, VP of Technology, Dave Malanga, Symposium Chair, Lee Levine and Don Havas, Technical Chair, the program will be stellar! Their hard work and planning will bring to you a technical program of presentations containing breakthroughs at the forefront of development. Forward thinking has to be the basis of everything we do in IMAPS.

Autumn in Philadelphia should be just right for you to get out and about in the evening after a hard day of intensive technical sessions. The site committee is going to great lengths to involve the local business community in support of our Symposium. We plan to provide you with a comprehensive menu of possible activities in the area. In addition to the contributions mentioned above, let’s give our support to the rest of the IMAPS 2005 Symposium committee: Bob Sutterlin, Joan Delalic, Greg Chesmar, Art Dobie, Ed Gildein, Howard Imhof, Marissa Kurpiewski, Barbara Malanga, Michael Salloum, Mike McLaughlin, and Ed Gildein. A great team that’s bringin’ it all together in Philly!
For those of you not familiar with the term PDC, it stands for Professional Development Course, typically a full or 1/2 day educational seminar taught by an industry expert at the National Show and focused on a specific technology area. Several courses that have run over the years have become very popular for attendees such as George Harmon’s “Wire Bond” course and Art Dobic/Rudy Bacher’s “Technology of Screen Printing.” These technology areas are fundamental to our industry and it’s a primary mission at IMAPS to provide top notch Professional Development Courses to our membership at large.

This year I’d like to expand the course offerings at the National Show to address some of the newer technology areas and accommodate our expanded Tech Program (i.e., Device level, 1st and 2nd level packaging and System Packaging). At the 2004 Symposium in Long Beach the PDCs and Tech Program tended to focus more on 1st and 2nd level packaging. Maybe this year we can offer some new PDC’s at the Device and System Packaging level. Also, in addition to the traditional “hands-on” wirebond and thick film courses, I’m open to new “hands-on” course offerings that focus on practical skills for operators/technicians/inspectors or the all-thumbs manager who needs an appreciation of skill sets needed to manufacture product.

If you or someone you know would like to teach a PDC at the Philly Symposium, please contact Jackki Morris at IMAPS and submit your proposal by the end of March. If you’d like to talk over some ideas or want to learn more about how to become a PDC instructor, then please call me direct at 610-730-3224.

See you at the PDCs in Philly
Tom Green
2005 PDC Chair
This special issue of *Advancing Microelectronics* focuses on ceramic interconnect technology and the 1st International Conference and Exhibition on Ceramic Interconnect and Ceramic Microsystems (CICMT).

The issue contains two papers which describe leading edge high frequency applications. Both combine advanced materials and processes with design and simulation in developing new high frequency applications. The paper “LTCC Short Range Radar Sensor for Automotive Application at 24 GHz” by P. Uhlig and his colleagues at IMST in Germany describes an automotive radar module with an integrated planar antenna array realized in Low Temperature Cofired Ceramic (LTCC). The high degree of integration enabled by LTCC and use of bare die lead to a very compact sensor module which can be manufactured at low cost. “Progress in the Integration of Planar 3D Coils on LTCC by using Photoimageable Inks” by Ruben Perrone and his colleagues at Ilmenau Technical University, also in Germany, describe techniques for the design and manufacture of miniature inductors useful in frequency ranges up to 10 GHz. This approach combines photoimageable thick film materials with laser drilled micro vias and buried cavities.

The Ceramic Interconnect Conference sponsored by the Ceramic Interconnect Initiative and IMAPS will be jointly sponsored in 2005 by IMAPS and the American Ceramic Society. The scope of the conference has been expanded to include microsystems and the conference renamed to reflect the expanded coverage. The renamed International Conference on Ceramic Interconnect and Ceramic Microsystems combines the complementary interests, strengths and leadership of the membership of both societies to focus on accelerating advances in both ceramic interconnect and microsystems. The conference will be held in Baltimore, April 10-13, in conjunction with the annual meeting of the American Ceramic Society.

The participation of speakers from 13 different countries reflects the international scope of this three-day conference. Six invited keynote speakers will provide comprehensive overviews of current and future directions in key areas including: ceramic microsystems, ceramic interconnect, materials and processing, automotive applications, and design and integration. Additionally, 57 contributed papers in 15 different sessions will address the latest advances in ceramic interconnect and microsystems. A session and panel discussion on the Business of Emerging Microsystems will feature the perspective of government, industry and national laboratories. Table top exhibits, some reserved for non-commercial organizations, will provide an opportunity for those involved in development and manufacturing to meet suppliers developing the infrastructure to support the industry.

This is a “must attend” meeting for those working in ceramic interconnect or microsystems. Please join us in Baltimore.
Progress in the Integration of Planar and 3D Coils on LTCC by using Photoimageable Inks

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Abstract:

This paper presents some results of our investigations in the integration of coils in LTCC using the Fodel® Technology as structuring technology. Planar as well as 3-D inductors were simulated, manufactured, measured and modeled. The structures were manufactured with different shapes, a line width from 30 µm to 70 µm, a space between turns from 100 µm and 200 µm and diameters of inner turns from 0.5 mm to 2 mm. The smallest and most critical inductors (0.5 mm diameter) were manufactured with vias, whose diameter were about 60 µm.

The manufacturing of smaller coils was possible due to the increased resolution of Fodel® thick-film inks also in inner layers in combination with micro vias, which were produced with a multifunctional Laser. Combining these technologies with buried cavities and a symmetric turn arrangement we obtained inductors that can be used in a wider range of frequencies (up to 10 GHz).

Key words: LTCC, Fodel® -inks, planar-and 3-D coils, RF-Properties

1. Introduction

The actual trend consists in developing new applications for higher frequencies and integrating as many functions and passive components in a module as possible. Thus, the LTCC technology plays a very important role because it offers a wide range of possibilities to produce multi-layer circuits and permits the integration of passive elements, such as planar, buried planar as well as 3-D inductors into the LTCC module.

Standard ‘thick-film’ inductors have a limited bandwidth of at most 1-3 GHz, due to the fact that the resolution of the standard screen printing technology does not allow to pattern smaller lines than 100 to 80 µm. The size of inductors is also limited by the via diameter (standard 100 to 150 µm) and stacking tolerances. In order to achieve an increased bandwidth the dimensions of coils must be reduced. Therefore an advanced thick-film technology with a high line resolution is required.

At the moment there are different advanced thick-film technologies that achieve an increased line resolution. Examples of them are the photoimageable, the photoetchable and the fine line printing processes.

The photoetchable technology involves a subtractive post-fire process, which makes it suitable only for fine line structures at the top or bottom layers. However, this technology can also be used in combination with photoimageable dielectrics to achieve fine line buried structures [1]. This mixed technology requires several post-fire printing and firing processes, which makes it more expensive and more time consuming as an ordinary photoimageable process, where all sheets can be processed in parallel and only one lamination and firing process is needed.

Regarding the fine line printing method, the costs of the printing screens are extremely high when a line resolution under 40 µm is required. Thus, for the prototyping or during the development phase of a module this structuring technology is economically unsuitable in comparison to the Fodel® technology.

The already mentioned facts conformed our motivation to characterize some Fodel® photoimageable inks from DuPont and to use them afterwards for the passive integration.

Finally, the aim to improve the RF properties of coils and to extend their bandwidth pushed us to combine Fodel® inks with other technological resources, such us laser generated micro vias, that permit a size reduction of coils, and buried cavities to reduce the parasitic capacitance of inductors to ground.

2. Technology Description

2.1. Photoimageable Thick Film process

This technology is a combination of conventional screen printing and a photoimageable process. It combines the advantages of thick- and thin-film technology and allows a high resolution under moderate costs. The manufacturing steps are represented in Figure 1. The first manufacturing step is the deposition of photosensitive ink on a substrate by blank screen printing. The ink is leveled at room temperature and then dried in a furnace at low temperature. Afterwards, the dried substrate is exposed to UV-light through a negative photo mask to form an image, which remains on the tape after development.

Figure 1: manufacturing steps of the photoimageable process

Figure 2: Fodel parallel Lines. Line width/space 30µm/30µm (l. - green/REM; r. - cofired/REM)
The Fodel® ink AG 6453 from Dupont was investigated and their process steps optimized. The best achieved resolution with the Ink AG 6453 was 13µm/21µm line width / line space on the top layers [2] and 25µm/15µm in the inner layers. Figure 2 shows two pictures of parallel lines on the top of a substrate before and after firing.

It was observed that the penetration depth of the UV light into the Fodel® Ink AG 6453 is limited. Therefore, only an upper surface layer becomes polymerized, whose thickness depends on the exposure time. Figure 3 shows this dependence.

When printed lines are thicker than the polymerized ink layer, the under-etching appears, which directly affects the shrinkage of the lines. For many applications it is very important to manufacture lines with a certain width. Therefore, the relation between the line width on the mask and the final width of lines after firing was investigated. This investigation was carried out for top and buried parallel lines. Figure 4 shows the results for the Fodel® conducting ink Ag 6453 on the LTCC Tape 951 from DuPont.

2.2. Vias generation

Two types of vias were used for the manufacture of the inductors. Standard punched vias with a fired diameter of 130 µm were used for all inductors with an aperture width of 1 and 2 mm. The smallest inductors, which have an aperture width of 0.5 mm, and all symmetrical inductors with a line space of 100 µm were manufactured with vias, whose diameter were about 60 µm. These vias were drilled with a multifunctional laser on the green sheets as in the process described in [3].

Afterwards, they were filled up with a via fill machine by using a metal via fill mask. The metal mask was also manufactured with the same laser. Figure 5 shows an unfilled via on a green tape and on a metal via fill mask.

2.3. Cavities

There were two substrates manufactured with coils with the same dimensions and shapes, one within buried cavities and one without cavities. The cavities were manufactured between the coils and the ground plane. Because of these cavities, the parasitic capacitance to ground of the turns is reduced.

Cavities could be generated either with a punching machine or with a laser. During the tape lamination and depending on the size of the cavity, they were filled up with a material that volatilized while firing. Figure 6 shows a cross-section of a fired cavity. The buried ground plane, a via and narrow turns can be recognized.

3. Geometrical properties of the Inductors

There were manufactured planar-spiral, planar-symmetrical with over-crossed turns and 3D inductors. The different types of inductors shapes are shown in Figure 7.

<table>
<thead>
<tr>
<th>Table 1: Geometrical properties of the manufactured inductors</th>
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<td><strong>Coil Type</strong></td>
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<td><strong>Aperture (µm)</strong></td>
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<tr>
<td><strong>Number of turns</strong></td>
</tr>
<tr>
<td><strong>Line width (µm)</strong></td>
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<tr>
<td><strong>Line space (µm)</strong></td>
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<tr>
<td><strong>Tape thickness (µm)</strong></td>
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The internal turn of planar spiral coils is connected to the measure line trough two vias and a buried line. The turn crossover of planar symmetrical inductors is also performed by 2 vias and a buried line. Because of this symmetrical turn arrangement the quality-factor of such inductors is enhanced and also maintained over a broader bandwidth than the quality-factor of spiral inductors [4]. The turns of the 3D coils are stacked over each other. Table 1 summarizes the inductor dimensions and their geometrical properties. Only inductors with an aperture of 0.5 mm were investigated in combination with buried cavities. In Figure 8 some planar-symmetrical inductors are shown with the same number of turns but several aperture widths. They were all photographed with the same magnification to make the difference in size more noticeable.

4. Measurement and Modeling

The S-Parameters of all inductivities were measured with a Network-Analyzer HP 8510 and coplanar probes from Cascade. In Figure 9 one can see the layout for measuring. The
The inductivity of spiral coils as a function of the aperture width and line width was investigated. The results for inductors with 1.5 turns are seen in Figure 10. One sees, that a reduction in the dimensions of coils increases their cut-off frequency and makes the inductance curve more planar. Note that the cut-off frequency of the inductors with an aperture width of 1 mm and 0.5 mm is higher than 8 GHz.

As written above, the RF properties of planar coils can be improved by using a symmetrical turn arrangement, which is commonly used in thin-film technology. In Figure 11, the inductivity of planar-spiral and planar-symmetrical coils are compared over the frequency. All Inductors have 50 µm line width, 100 µm line space and 475 µm tape thickness.

One sees that the inductivity of symmetrical inductors remains constant over a wider frequency range as the inductivity of spiral ones. Some coils have not reached their cut-off frequency up to 10 GHz.

According to [6], the RF properties of inductors can be improved if their parasitic capacitance to ground is reduced. Therefore, coils with cavities between them and the ground plane were manufactured. The inductivity and parasitic capacitance to ground of these inductors were measured at 1 MHz with a LCR meter HP 4284A.

In Figure 12 the parasitic capacitance of coils with and without cavities in dependence of the number of turns and the line width. One sees that the introduction of cavities under coils causes the parasitic capacitance to decrease drastically. This reduction in the parasitic capacitance leads really to better RF properties. This can be noticed in Figure 13, where the inductance over the frequency of coils with and without cavities are compared. One sees that inductors with buried cavities have a higher cut-off frequency and a more planar inductance curve than inductors without cavities.

In Figure 14 the inductance of 3D round coils is shown with different number of turns. An important point to remark is that the inductivity of the coil with 1.5 turns remains almost constant up to 5 GHz and up to 8 GHz the coil has not reached its resonant frequency. That indicates that this kind of inductors can also be used up to 5 GHz or more for some special applications.

Figure 15 shows a lumped element model, which corresponds to a round planar spiral inductor with an aperture width of 1 mm, 1.5 turns and 30 µm line width. Figure 16 shows the comparison between the measured and modeled S-Parameters for this inductor.

\[
\begin{align*}
Z &= \frac{\left(1 + S_{11}\right)\left(1 + S_{22}\right) - S_{12} S_{21}}{2 S_{12}} \\
I &= \frac{50 \cdot \text{Im}(Z)}{2 \cdot \pi \cdot f} \\
Q &= \frac{\text{Im}(Z)}{\text{Re}(Z)}
\end{align*}
\]

Where \(f\) = frequency
5. Conclusions

The integration of Fodel® structures in inner layers of LTCC and the combination of photoimageable inks and laser generated microvias was proven to be possible.

Planar and 3D inductors with small line widths (< 50 µm) and small aperture widths and therefore better RF properties than standard thick-film coils were manufactured in LTCC.

Planar symmetrical inductors were manufactured in thick-film technology. These inductors have a higher cut-off frequency and their inductance is less dependent on the frequency compared to ordinary spiral inductors.

An important improvement of the RF properties of inductors can be achieved through the manufacture of a buried cavity between the inductor and the ground plane.

An accurate model up to 8 GHz for each inductor was determined.

6. References


LTCC Short Range Radar Sensor for Automotive Applications at 24 GHz

P. Uhlig, C. Günner, S. Holzwarth, J. Kassner, R. Kukke, A. Lauer, M. Rittweger, IMST GmbH, D-47475 Kamp-Lintfort, Germany, www ltcc de

Abstract:
This paper presents the concept, design and measurement results of a FMCW radar module with an integrated planar antenna array, realised in LTCC (Low Temperature Cofired Ceramics) technology, for automotive applications operating at 24 GHz. A car manufacturer has specified the requirements for antenna and microwave module. The resulting design concept is discussed and subsequently, simulation and measurement results are presented to verify the feasibility of the concept. The high degree of integration enabled by LTCC leads to a very compact sensor module. Considerate material selection and hybrid integration of discrete semiconductor devices lead to very competitive production costs. The well-established screen-printing process used in LTCC is a further benefit in the mass production of this rugged design.

Keywords: LTCC, 24 GHz, Radar Sensor, FMCW, Planar Antenna, Automotive

Introduction
The RADAR-sensor presented here is designed for use as a driver assistance system in vehicles. FMCW method is utilized to measure distances up to 30 m and velocity of obstacles around the car. Especially safety enhancement systems like collision warning and mitigation but also comfort features can be realized. Moreover, the sensor is capable of being integrated in manifold industrial applications where distance and velocity have to be determined with high precision. Another interesting field of application is the monitoring of buildings and real estate, because the module concept is qualified for the free 24 GHz ISM band, too.

For the production of highly integrated modules, LTCC is appreciated for its flexibility in realising an arbitrary number of layers with easy to integrate circuit components like thick film resistors, cavity buried or top-mounted SMT components, or even chip devices.

Basic Principle of Operation
Unlike most of the other electronic solutions for radar sensors available to today’s car industry, which are based on pulse methods, the sensor featured in this paper is based on the FMCW principle of operation. The carrier signal of the radar is frequency modulated in linear ramps. The sensor receives and transmits simultaneously, and the frequency difference \( \Delta f \) between the transmitted and received signal (e.g. between two objects) is proportional to the time difference of the two signals. The time difference of the two signals is in turn proportional to the distance between the transmitter and the reflecting object, thus determining very accurately, through the frequency difference \( \Delta f \), the distance between the two objects.

Specifications of the RADAR module:

**RF-Module**
The main focus of the development is directed towards the reduction of costs in comparison with conventional sensors. Hybrid circuit technology using a 5-layer LTCC substrate from DuPont Microcircuit Materials has been realized. The module is assembled with cost-effective discrete semiconductor devices, avoiding the use of expensive monolithic integrated circuits (MMICs). The patch-antenna is printed on one side of the multilayer ceramic, while the RF front-end has been integrated on the opposite side. The microwave front-end with the integrated patch antenna measures only 34 mm x 21 mm. Signal conversion and signal processing are executed on an external board, which is connected via USB interface to a PC. All results are evaluated and presented on the computer. Software with graphical user interface allows the setting of sensor and evaluation parameters.

Figure 1: Block Diagram
The Voltage Controlled Oscillator (VCO) provides the frequency modulated transmit signal. A single stage class A buffer amplifier isolates the VCO and delivers the appropriate transmit power level. The branch-line 90° hybrid coupler is used to direct the incident wave to the antenna and the mixer and the reflected wave from the antenna to the mixer. The single balanced mixer consists of a rat-race coupler and a matched pair of diodes. For further processing the IF-output of the module is amplified.

Antenna Requirements
The antenna has to comply with the following specifications: The operation frequency range is defined by a centre frequency of 24 GHz, with a bandwidth of at least 2 GHz. This broadband behaviour is important, since the range of the frequency modulation ramp of the radar module defines its resolution. The polarisation of the antenna has to be linear, with a high suppression of the cross polar components. The antenna pattern should meet the 3 dB beam width requirement of ±15° in the E-plane and ±30° in the H-plane. Of course, other automotive radar applications might require a different antenna pattern. It is therefore important to point out that the concept presented here could easily be adopted to other requirements by changing the number of elements in the array, while maintaining the basic antenna architecture, and thus the broadband characteristic of the antenna.

Antenna Concept
The radar module consists of five LTCC layers, each with a 200 μm layer thickness. Fig. 1 depicts the layout of the complete FMCW module; Fig. 4 shows this module in a cross sectional view. The bottom side of the ceramic block carries the RF front-end circuits and components. An aperture in the buried ground plane between the first and second ceramic layer (counted from the bottom), is used to interconnect RF and antenna circuitry. The antenna array and its feeding lines are located between the third and fourth layer. Stacked patches on the topside of the ceramic are used to enhance the bandwidth of the antenna [2]. The ceramic material consists of DuPont 951-AT green tape, with a dielectric constant of 7.8, and a loss tangent of 0.008 [1]. This material has been favoured for reasons of economy, since it is cheaper than the similar low loss material, DuPont 943-A5, with an indicated loss tangent of 0.001 [1].

The complete antenna has been calculated including the RF-to-antenna interface using the FDTD simulator EMPIRE [3]. The simulation results in Fig. 5 show the calculated return loss of the antenna. The 10 dB bandwidth of the antenna is about 2.5 GHz, giving a relative bandwidth of over 10%. Considering the high dielectric constant of the material used, this is a remarkably good result. The simulation results of the far field behaviour are depicted in Fig. 6 and Fig. 7. The directivity of the antenna is calculated to be 12 dBi, with a 3 dB beam width of ±15° in E-plane, and ±30° in H-plane, respectively. The antenna has been manufactured and measured in a small number of prototypes. For the antenna under test, the RF circuits on the bottom side of the module have been removed except for a microstrip line that is.

Continued on page 12
feeding the aperture of the RF-to-antenna interface. The influence of this interface is thus included in the measurement results. A SMP plug and an SMP-to-K interface is used to connect the microstrip line on the ceramic to the measurement system.

Fig. 5 shows the measured 10 dB bandwidth of the antenna. The deviations between simulation and measurement results can be explained by the fact that the calibration of the measurement system did not include the influence of the SMP plug nor the SMP-to-K interface. Despite these differences, the measurements clearly verify the wideband characteristic of the antenna.

Fig. 6 and Fig. 7 show the measured far field patterns of the antenna at 24 GHz in comparison with the simulation results. It can be stated that there is a good agreement between the calculated and measured radiation patterns. Moreover, the suppression of the cross-polar level is about 20 dB, meaning a good polarisation purity of the antenna. The difference between the calculated directivity and the measured antenna gain of about 10 dB can be ascribed to losses in the material as well as in the feeding line and the connectors. This means that the actual gain of the integrated antenna will be slightly higher, since the connectors are only used for measurement purposes, and the length of the microstrip feeding line on the RF side will be reduced.

Conclusions
The high density of interconnects in LTCC substrates facilitates the integration of patch antenna, microwave front-end, IR electronic and optional digital part on one single multilayer LTCC substrate. Utilization of multilayer ceramic for microwave circuits allows the use of bare semi-conductor dies and the abandonment of microwave monolithic integrated circuits (MMIC), which lowers the costs, increases the availability of components and expands second source capabilities. Inherent housing properties like hermeticity, thermal conductivity and good CTE-match to semiconductors make LTCC an ideal candidate for compact and environmentally rugged modules. Despite the high dielectric constant of the LTCC material, the presented antenna concept exhibits broadband behaviour by exploiting the LTCC multilayer characteristics. The presented simulation and measurement results verify this appealing concept, which is flexible enough to be easily adapted to other radar application requirements. These advantages result in a compact Radar module, which summarizes outstanding properties like small dimensions, proper performance as well as low costs.

Acknowledgement
The work of this paper is derived from a joint project of IMST GmbH with DuPont Microcircuit Materials.

References
Assembléon Installs ACM Pick and Place Machine at Auburn University

The Laboratory for Electronics Assembly and Packaging (LEAP) at Auburn University has announced the installation of an Assembléon ACM Micro into its advanced SMT and flip chip line. The ACM provides fine pitch and high placement accuracy capability for 01005 chip components, advanced flip chip devices, and 3-D modules.

“The advanced placement capability of this system will significantly enhance our research and educational programs,” says laboratory director and engineering faculty member Wayne Johnson. “The system is compatible with both laminate and ceramic substrates and will also be used to assemble 50um thick silicon die onto flex substrates.”

With 3,500 square feet of dedicated facilities, LEAP provides state-of-the-art electronics manufacturing, packaging, characterization, reliability testing and failure analysis capability enabling world-class research in electronics assembly and packaging. The laboratory supports the research efforts of the NASA-JPL University Consortium for Extreme Environment Electronics, the NASA Center for Space Power and Advanced Electronics and the NSF Center for Advanced Vehicle Electronics as well as other research projects. Many consider it one of the leading facilities of its kind in the nation.

“The projects undertaken by the LEAP facility serve to qualify and define critical process parameters and techniques required to maximize production yield long before a technology becomes mainstream,” confirmed Brent A. Fischthal, Product Manager.

“Moreover, the opportunity to actively participate in the bleeding-edge projects not only confirms the inherent capabilities of the Assembléon ACM Micro, it also ensures Assembléon products will continue to provide the required machine features to handle future technologies.”

For more information, log on to www.eng.auburn.edu/department/ee/leap or contact Wayne Johnson at 334.844.1880 or johnson@eng.auburn.edu.
IMAPS/ACerS 1st International Conference and Exhibition on
Ceramic Interconnect and Ceramic Microsystems Technologies (CICMT)
http://www.cicmt.org

Co-located with the 107th Annual Meeting of The American Ceramic Society -
http://www.ceramics.org/meetings/am2005

Baltimore Marriott Waterfront Hotel
Baltimore, Maryland USA
April 10 - 13, 2005

General Co-Chairs:
Samuel J. Horowitz, *DuPont*
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David Wilcox, *Consultant*
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Everything in electronics between the chip and the system!
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*Exhibit Hours:*
4/12/05  5:00 PM - 8 PM
4/13/05  10 AM - 2 PM

Lunch & Refreshment Breaks
will be held in the Exhibit Hall
Ceramic Interconnect and Ceramic Microsystems Technologies
Technical Program Overview
April 10-13, 2005

Sunday, April 10
Frontier of Science and Society - Rustum Roy Lecture: 5 pm - 6 pm
Speaker: Dr. Arden L. Bement, Jr., National Institute of Standards and Technology

Monday, April 11
Opening Remarks: 8 am - 8:30 am
Conference Chairs

Keynote Presentations: 8:30 am - 9:30 am
Title: Future Challenges and Opportunities in Multilayer Ceramic Technology

Keynote Presentations: 9:30 am - 10:30 am
Title: Current and Future Directions for Ceramic Interconnect
Speakers: Christian Hoffmann, Sebastian Brunner, Markus Noren, EPCOS OHG

Edward Orton, Jr. Memorial Lecture: 11 am - Noon
Title: An Innovative Ceramic Technology Success - LTCC from Laboratory to Electronics Applications in the Market Place
Speaker: Dr. Peter Barnwell, Custom Interconnect Ltd, UK

Keynote Presentation: 1 pm - 1:55 pm
Title: Materials Process and Manufacturing: Current and Future Directions
Speaker: Andreas Roosen, University of Erlangen - Nuremberg

Session MP1: Materials Solution for Microsystems
Chair: Heiko Thust, Technical University of Ilmenau
2 pm - 3:20 pm
On-Board Fiber Alignment in LTCC Optoelectronic Packages
Richard E. Eitel, Amanda Baker, Jose Agraz, Mike Lanagan, Kenji Uchino, Clive Randall, The Pennsylvania State University

Photosensitive Dielectric Paste for Micro-Patterning Technology in LTCC System
Hyo Tae Kim, Kui Won Kang, T. Masaki, Kwang Jin Kim, Jonghee Kim, Korea Institute of Ceramic Engineering & Technology

Micro Channel Fabrication in LTCC Substrate
W. Kinzy Jones, Surya Kappagantula, Jaing Wang, Florida International University

Development and Evaluation of Hermetic Ceramic Microwave Packages for Space Applications

Session MP2: Cofiring
Chairs: Fred Barlow, University of Arkansas; Martin Oppermann, EADS Deutschland GmbH
2 pm - 3:20 pm
Camber and Stress Development during the Cofiring of Bi-Layer Ceramic Dielectric Laminate
Jau-Ho Jean, R. T. Hsu, National Tsing Hua University

The Study of Graded Joining of Alumina and Zirconia Ceramics in Green State
Boran Tian, Jiachen Liu, Tianjin University

Direct Interconnecting of CePO4/ZrO2 Composites in Green State
Libin Liu, Jiachen Liu, Tianjin University

Session MP3: Microsystem Materials & Integration
Chair: Bob Freer, University of Manchester/UMIST
3:40 pm - 5 pm
Integration Concepts for the Fabrication of LTCC Structures

Development and Processing of an Anodic Bondable LTCC Tape
Edda Müller, B. Pawlowski, P. Rothe, R. Ehrt, A. Heymel, E. Weiland, K. Kaschlik, VIA Electronic GmbH

Fabrication of LTCC Micro-Fluidic Devices using Sacrificial Carbon Layers

LTCC Phase Shifter Modules for RF-MEMS-Switch Integration
Thomas Bartnitzek, Edda Müller, VIA Electronic GmbH; Raymond van Dijk, TNO-FEL

Session MP4: Dimensional Control in LTCC Systems
Chairs: Adam Schubring, Visteon Corporation; Walter Rothlingshofer, Robert Bosch GmbH
3:40 pm - 5 pm
Zero Shrinkage of LTCC by Self-Constrained Sintering
Torsten Rabe, Wolfgang A. Schiller, Federal Institute for Materials Research and Testing; Thomas Hochheimer, Heraeus Inc. Circuit Materials Division, USA; Christina Modes, Annette Kipka, W.C. Heraeus GmbH, CMD, Germany

Self Constrained Sintering LTCC - A Reliable Solution for Automotive Electronic Application
Christina Modes, Annette Kipka, Quentin Reynolds, Michael Neidert, Stefan Malkmus, Frieder Gora, Heraeus Circuit Materials Division

Via Fill for Zero X-Y Shrink LTCC Tapes
Weiming Zhang, Tom Hochheimer, Peter Bokalo, Heraeus Incorporated-Circuit Materials Division

Vertical Self-Constrained Sintered Composites of Dielectric and Ferrite LTCC Tapes for Microwave Applications
Marcel Hagymasi, Andreas Roosen, University of Erlangen-Nuremberg; Roman Karmazin, Stefan Walter, Siemens AG

continued page 16
Tuesday, April 12

Keynote Presentation: 8 am - 8:55 am
Title: Ceramic Microsystems for Automotive Applications
Speaker: Gerhard Schneider, Robert Bosch GmbH

Session TA1: Ceramic Microsystems and Applications I
Chair: Leszek Golonka, Wroclaw University of Technology
9 am - 10:20 am
- Progress in MEMS and Micro Systems Research
  Chang Liu, University of Illinois at Urbana
- Microfabrication of Highly Piezoelectric Microcantilevers for Sensor Applications
  Wei-Heng Shih, Zuyan Shen, Wan Y. Shih, Drexel University
- Miniaturized Sensor Elements based on LTCC Technology for Automotive and Airborne Applications
  Ulrich Schmid, Helmut Seidel, Thomas Becker, Saarland University
- LTCC Sensors for Environmental Monitoring System
  Mario R. Gongora Rubio, Patrick B. Verdonck, Sergio Takeo Kofuji, Antonio C. Seabra, Emilio Del Moral Hernandez, Elíphias W. Simões, Marcelo Barbato A. Fontes, Instituto de Pesquisas Tecnológicas (IPT)

Session TA2: Processing Integrated Passives in LTCC
Chair: Raghu Settaluri, Oregon State University
9 am - 10:20 am
- Post-Thermal Heat Treatment for Adjusting Buried Resistor Values in DuPont 943 LTCC
  Daniel S. Krueger, Elizabeth Parker, Gregg Barner, Honeywell FM&T, Fernando Uribe, Scott Reed, Sandia National Laboratories
- Thin Film Technologies for Integrated Passives
  Kyung-Ku Choi, Shigeki Satou, TDK Corporation
- Characterization of Dried Thick-Film Resistors
  Klaus Krueger, Helmut-Schmidt University
- Methods to Improve Yield and Efficiency in Laser Trim of Embedded Components

Session TA3: Ceramic Microsystems and Applications II
Chair: Amy Moll, Boise State University
10:40 am - Noon
- Novel Microsystem Applications with New Techniques in LTCC
  Ken A. Peterson, Kamlesh Patel, Clifford Ho, Steve Rohde, Chris Nordquist, Charles Walker, Brian Wroblewski, Sandia National Laboratories
- Real-Time, in SITU, Biodetection and Quantification using Piezoelectric Microcantilevers
  John-Paul McGovern, Wei-Heng Shih, Wan Y. Shih, Drexel University
- Nerve-Gas Simulant, Dimethyl Methylphosphonate (DMMP) Detection using Array Piezoelectric Microcantilevers
  Wei-Heng Shih, Qing Zhu, Wan Y. Shih, Drexel University
- Preparation of Polymeric Microspheres by an Emulsification/Solvent Diffusion Process Employing LTCC Microfluidic Structures
  Mario Ricardo Gongora-Rubio, Márcio Rodrigues da Cunha, Alcione Penido de Oliveira Costa, Maria Inês Ré, Instituto de Pesquisas Tecnológicas

Session TA4: Materials Integration in LTCC
Chair: Larry Zawicki, Honeywell Federal Manufacturing and Technologies, LLC
10:40 am - Noon
- Low Sintering Ni-Cu-Zn-Ferrite Tapes for LTCC Integrated Inductors
  Stefan Barth, F. Bechtold, E. Müller, VIA Electronic GmbH; J. Mürbe, J. Töpfer, Fachhochschule Jena, Herrmsdorfer Institut für Technische Keramik
- Micron Scale Conductors and Integrated Passives in LTCCs by Electrophoretic Deposition
- Bulk Materials in LTCC Multilayers
  Michael Hintz, Technical University of Ilmenau
- Miniaturizing the Size of Microwave Filters by using LTCC Technology with Hybrid Dielectrics
  W. S. Lee, Y. C. Lee, Y. Z. Chung, National Cheng Kung University

Global Business Council:
1:30 pm - 4:30 pm
Business of Emerging Microsystems

Panel Discussion
Ceramic Microsystems: The Path Forward
Moderator: Dr. D. L. Wilcox, Consultant

Panel Members:
Mr. Dan Amey, E. I. DuPont
Mr. Jonathan Bost, JRB Consulting, LLC
Dr. Art Chait, Eoplex Technologies, Inc.
Mr. Walter Roethlingshoefer, Robert Bosch GmbH
Prof. Dr. Andreas Roosen, University of Erlangen-Nuremberg

Reception/Dinner in the Exhibit Hall:
5 pm - 8 pm

Wednesday, April 13

Exhibit Hours: 10 am - 2 pm
Keynote Presentation: 8 am - 8:55 am
Title: Integrated Design and Simulation Tools for Microsystems Packaging: Current Capabilities and Future Needs
Speaker: Marc Desmulliez, Heriot Watt University
Session WA1: Design and Fabrication of Ceramic Microsystems and Devices
Chair: Torsten Rabe, Federal Institute for Materials Research and Testing
9 am - 10:20 am
Modular Micro Reaction System including Ceramic Components
Tassilo Moritz, Reinhard Lenk, Jörg Adler, Michael Zins, Fraunhofer Institute for Ceramic Technologies and Sintered Materials

Ceramics in Microtechnology - Materials, Processing, Design
Hans-Joachim Ritzhaupt-Kleissl, Jürgen Hausfelt, Robert Ruprecht, Forschungszentrum Karlsruhe, Institut für Materialforschung III

Integrated Design and Simulation of Microfluidic Devices
S. Krish Krishnamoorthy, Jerry Feng, Aditya S. Bedekar, Shankar Sundaram, CFD Research Corporation

Fabrication of Microfluidic Oscillators by Laser Milling in Sintered LTCC and Quartz Substrates
Rogerio Furlan, Miguel Perez Tolentino, Idalia Ramos, Jorge J. Santiago-Aviles, University of Puerto Rico at Humacao

Session WA2: Design, Simulation and Modeling
Chair: Daniel Amey, DuPont Microcircuit Materials
9 am - 10:20 am
Material Selection for Ceramic T/R Module Packages
Reiichi Yamada, Andrew Piloto, Ed Graddy, Gerardo Aguine, Mark Eble, Arne Knudsen, Kyocera America, Inc.

Designing with LTCC in High Frequency Applications
Timothy P. Mobley, Daniel Amey, DuPont Microcircuit Materials

High-Performance Co-Planar Ferrite Inductors for RF Applications
Michael D. Phillips, Raghu K. Settaluri, Chih-Hung Chang, Oregon State University

Novel Crosstalk Suppression Schemes Employing Magnetic Thin Films
Arien Sliga, Raghu K. Settaluri, Chih-Hung Chang, Oregon State University

Session WA3: Ceramic Microsystems and Devices
Chair: Klaus-Dieter Lang, Fraunhofer IZM
10:40 am - Noon
LTCC Microfluidic System
Leszek J. Golonka, J. Radojewski, H. Roguszczak, M. Stefanow, T. Zawada, Wroclaw University of Technology

Meso-Scale Remote Plasma Generator using LTCC Technology
Roberto Katsuyori Yamamoto, FATEC-SP/CEETEPS and LSI/PSI/USP, Patrick Bernard Verdonck - LSI/PSI/USP, Mario Ricardo Gongora-Rubio - IPT

Micro-Channel Device in LTCC
Amy J. Moll, John M. Youngsman, Donald G. Plumlee, Boise State University

Processing of Ceramic Microparts via Low-Pressure Injection Molding
Marcus Müller, Werner Bauer, Hans-Joachim Ritzhaupt-Kleissl, Forschungszentrum Karlsruhe, Institut für Materialforschung III

Session WA4: Characterizing Materials Integration Effects
Chair: Daniel Krueger, Honeywell FM&T
10:40 am - Noon
Characterization of Dielectrics and Conductors for Ceramic Microsystems at Microwave Frequency

Materials Compatibility issues in LTCC Technology and their Effects on Structure and Electrical Properties
Hansu Birol, T. Maeder, C. Jacq, P. Ryser, Swiss Federal Institute of Technology

Sintering Behavior of LTCC and Influence of Silver on the Sintering Behavior
Dragan Tramosljaka, Joerg Schaefer, Robert Bosch GmbH (AE/WZK); Georg Rixecker, Fritz Aldinger, Max Planck Institute

Study on the Interfacial Reaction between Silver Electrode and La-Si-B-O-mullite Glass Ceramics
Yu Ju Wang, Wen-Cheng J. Wei, National Taiwan University

Keynote Presentation: 1 pm - 1:55 pm
Title: Next-Generation Microsystems: Integration Technologies and Opportunities for Ceramics
Speaker: Duane Dimos, Sandia National Laboratories

Session WP1: Ceramics: The Microsystem Device Enabler
Chair: Paul Clem, Sandia National Laboratories
2 pm - 3:20 pm
LTCC Wet Chemical Analysis Meso-Systems
Núria Ibáñez-García, Alonso Chamorro, Julián Mendes da Rocha, Mario Zaira Gongora-Rubio, University Autonomous of Barcelona

Development of Microfluidic Devices using LTCC Substrates
Roberto Eduardo Bruzetti Leminski, Eliphas Wagner Simões, Rogerio Furlan, Idalia Ramos, Mario Ricardo Gongora-Rubio, Nilton Itiro Morimoto, J. J. Santiago-Aviles, Universidade de São Paulo

Hot-Plate Gas Sensors - Are Ceramics Better?
Kita Jaroslaw, Frank Rettig, Ralf Moos, University of Bayreuth; Karl-Heinz Drüse, Heiko Thust, Technical University of Ilmenau

A Comparative Study of Technology and Architecture for Actuators realized with PZT Layers in LTCC Structures
Darko Belavic, Marko Hrovat, Janez Holc, Marija Kosec, Barbara Malic, Marina Santo Zarnik, Sivo Drnovšek, Jena Cilensek, HIPOT-R&D and Jozef Stefan Institute

continued page 18
Session WP2: Ink Jet Printing Technology
Chairs: Veena Tikare, Sandia National Laboratories; Tom Swiler, Sandia National Laboratories
2 pm - 3:20 pm
Ink Jet Printing and Sintering PZT
Brian Derby, Tianming Wang, University of Manchester

DoD-Printing of Conductive Silver Tracks
Dominik Cibis, Klaus Krueger, Prof. Dr.-Ing., Helmut-Schmidt University

Session WP3: Microsystem Materials and Fabrication
Chair: Dean Anderson, TRS Ceramics, Inc. and The Pennsylvania State University
3:40 pm - 5 pm
Via Formation in LTCC Tape: A Comparison of Technologies
Klaus-Jurgen Wolter, Dresden University of Technology; Gunter Hagen, KMS Kemmer Technology Center - Dresden

Direct-Write Laser Exposure of Photosensitive Conductive Inks using Shaped-Beam Optics
Scott S. Corbett, Jeff Strole, Wilson Lu, MicroConnex; Edward Swenson, ElectroScientific Industries

High-Volume Print Forming, HVPF™ - A New Method for Manufacturing Large Volumes of Complex Metal-Ceramic and Hybrid Components
Arthur L. Chait, EoPlex Technologies, Inc.

Cold Low Pressure Lamination of Structured Ceramic Green Tapes
Andreas Roosen, Karin Schindler, University of Erlangen - Nuremberg

Closing Remarks: 5 - 5:10 pm
Passives Integration ATW - A Report from the General Chair

With clear but exceptionally cold weather for South Florida in late January as a backdrop, 35 participants met on Jan 24 - 26 at the Marco Island Hilton for the IMAPS ATW on Passive Integration. There were 18 formal papers, with extra presentations in an evening session on ‘late developments.’ Folks from Netlist and Intel were persuaded to discuss the latest in very dense memory modules with integrated terminating resistors, and decoupling needs for future microprocessors, respectively.

There were a few lively discussions on the relative merits of ceramic/polymer composite versus thin film dielectrics, with several papers devoted to each fabrication methodology. Thin film will excel in capacitance density once it is available, but for the present, ceramic/polymer composites are being used in production.

There were several papers on integrated RF filters for cell phone and other applications. This is clearly an area to watch.

Papers were almost uniformly excellent, with lots of new information not previously discussed publicly.

The camaraderie of the workshop atmosphere fostered by cocktail hours and good food resulted in many good contacts being made among the participants, with many opportunities for new customer/supplier relationships. All in all, this was a fine technical and community-building experience for all who participated.

Best,
Len
Dr. Leonard Schaper
Professor, Electrical Engineering
University of Arkansas
European Activities & Calendar of Events:

Benelux:
Meetings Programme:
- 15th European Microelectronics and Packaging Conference & Exhibition - EMPC2005

Please already now mark your calendar for this event, which will take place in beautiful Brugge, Belgium, June 12-15.
www.empc2005.be

France:
Meetings Programme:
- Interconex 2005, Grenoble, September 27-28

New date, new location. After the success of Interconex 2004, the board of IMAPS France decided to move, for the first time, the annual forum from the Parisian region. Grenoble congress centre EUROPOLE has been selected for the next INTERCONEX, September 27 - 28.

With an uncommon gathering of laboratories, research centres and innovative companies, the Grenoble region is a first rank technopole in Europe, for microelectronics and, more recently, for nanotechnologies and MEMS.

In order to help everybody make, as soon as possible, the necessary arrangements, IMAPS France and Interconex, have already issued a first brochure and open the reservation for the exhibition stands.

Well integrated in the European transportation networks, Grenoble can be easily reached by TGV-high speed train, highways and airlines from the main European and French cities.

We shall have future opportunities to come back on the call for papers and on the technical programme.

The technical committee decided to organise it around two leading topics:
- The BGA assembly, already in industrial use and keeping a strong potential of future development
- An advanced technology topic, the packaging of MEMS.

IMAPS France expects a strong involvement of the members for the success of the exhibition and of the conference as well.

News from the Chapter:
- IMAPS France web site
Here you will find short news, main events, IMAPS France membership registration on-line and an open discussion forum. Visit us @: www.imapsfrance.org
Links are available for direct access to other chapters in Europe and the United States.

- More information?
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Web: www.imapsfrance.org
Input from France must be sent to jean-paul.droguet@wanadoo.fr

Germany:
Meetings Programme:
- Advanced Packaging Conference, Munich,April 11
Semiconductor Equipment and Materials International (SEMI), and the European Chapter of International Microelectronics And Packaging Society (IMAPS) are organising the Advanced Packaging Conference. The technical conference will focus on solutions in advanced device packaging manufacturing operations:

SESSION I: New Technologies, Challenges & Opportunities
Invited paper: Carlo Cognetti, STMicroelectronics
Z-Axis Interconnection for Enhanced Wiring in Organic Laminate Electronic Packages, Voya Markovich, Endicott Interconnect Technologies
Wafer Level Packaging on Cu/K-Au, high density Back-end Integrated Circuits, Rainer Pelzer, EV Group and IMEC
Reliable Adhesion-Enhanced Leadframes plated with Ultrathin Ni/Pd/Au, Juergen Bartbemmes, Atotech
Quantitative measurement and determination of intermetallic compounds through EDX and image processing, Carlo Orofino, Fairchild Semiconductor

SESSION II: Advanced Manufacturing Processes, Materials and Automation
C4NP: Next Generation Lead-Free Solder Bumping, Dietrich Tönnies, Suss MicroTec
The Challenge to Optimize a Flip Chip and wire Bond Stacked Die Package, Jens Pohl, Infineon Technologies
Stencil printing for fine pitch wafer level bumping, Robert Kay, MicroStencil
Latest Developments in DRIE for integration of Passive components and Wafer-Level Packaging, M. Muech, Alcatel Vacuum Technology

Corporate Assembly and Test Strategic Production Management Productivity and Operational Excellence, Norbert Hauweis, Infineon Technologies

Main Progress on WLP for Different Applications, Gilles Poupin, CEA-LETI
More details, Dr. Jens Müller, jens.mueller@imaps.de, telephone: +49 929378700

Italy:
Meetings Programme:
- IMAPS Italy events 2005:
For more information look at: www.imaps-italy.it

Nordic:
Meetings Programme:
- IMAPS Nordic annual conference, Toensberg, Norway, September 11-14
The yearly conference will take place at Tonsberg, located in the heart of the Norwegian “Electronic Coast” with its major microelectronics and microsystems activities.

Tonsberg has easy access from the local international Sandefjord airport (TRF) with direct flights from London, Amsterdam, Frankfurt, Copenhagen, Stockholm.
The conference will focus on Tough environments, Hi-temp electronics, Advanced packaging, Micro system technologies and sensors.

Please study the Call for papers at www.imapsnordic.org

News from the Chapter:
- New board
  For 2005 and 2006 the IMAPS-Nordic board is:
  President: Søren Norlyng, MICRONSULT, Denmark
  Vice-President: Paul Collander, Poltronic, Finland
  Treasurer: Terho Kutilainen, Asperation, Finland
  Secretary: Dag Ausen, SINTEF, Norway
  Board members:
  Dag Vinge, Kitron Microelectronics, Norway
  Mats Lindgren, Kitron, Sweden
  Hans Danielsson, MikroElektronik Konsult, Sweden
  Kenneth Dahlberg, St. Jude Medical, Sweden
  Jørgen Skindhøj, Oticon, Denmark

Poland
Meetings Programme:
- IMAPS Poland 29th International Conference, Darlowek, September 19-21
  The 29th IMAPS-Poland International Conference is organized by the Technical University of Koszalin and the IMAPS - Poland Chapter in Hotel “Jan” in Darlowek at the Baltic Seaside (about 30 km from Koszalin).

The programme of the 29th IMAPS-Poland International Conference will consist of:
- Oral presentations of invited speakers
- Poster presentations of original work

The organizers invite researchers and engineers from universities, independent laboratories and industry for their contributions. Authors are invited to submit abstracts reflecting original work not previously published or presented elsewhere. Abstract should address innovative concepts or significant technical and scientific advances in microelectronic components, packaging and interconnection. The conference language is English.

The conference topics include:
1. Assembly Technologies (Conductive Adhesives, Pb-Free Solders, Surface Mount, Others)
2. Electrical, Thermal and Mechanical Design, Modeling and Simulation, Thermal-Wave Investigations
3. Environmentally-friendly Electronics
4. Microelectronic Materials, Packaging and Interconnection - Diagnostics, Quality and Reliability
5. Microelectronics Applications in Automotive, Space and Military

Continued on page 22
Electronics, Data Processing, Wireless Telecommunication, Medicine and Biotechnology

6. New Materials (Ceramic, Polymeric, Composites) and Film Technologies: New Application of Standard Deposition Methods (Polymer Active Devices)

7. Packaging and Interconnection (High Density, Low Cost, Wafer Scale, Encapsulants, MEMS, Optoelectronics)


9. Printed Circuit Boards, PCB and SMT Technologies

10. Education in Microelectronics and Packaging

Scientific Committee:
Prof. Leszek Golonka (Chairman) - the complete list of Scientific Committee members will be announced soon

Organising Committee:
Zbigniew Suszynski (Chairman), Piotr Majchrzak (Secretary), Robert Arsoba, Radosław Duer, Tomasz Juszkiewicz

Important dates:
- April 17, Submission of abstracts and registration forms (electronic submissions are strongly recommended)
- May 1, Notification of acceptance of papers (on the basis of submitted abstracts)
- June 5, Submission of the full text of papers (electronic submissions are strongly recommended) and conference fee

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http://imsaps2005.man.koszalin.pl
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Romania
Meetings Programme:
- SIITME 2005 September 22-25, Cluj-Napoca, Romania

More info: http://www.siitme.ro

News from the Chapter:
- 10th SIITME, International Symposium for Design and Technology of Electronic Packages

This jubilee event took place at University “Politehica” of Bucharest, Romania, September 23 - 26, 2004. SIITME is a conference with a high scientific level focused on electronic packaging, wishing to improve and to implement new technologies in electronics. This is an annual event in Central and Eastern Europe since 1995. SIITME is strongly supported by the Romanian Ministry for Education and Research. IMAPS Romania and ARIES (Romanian Association for Electronic and Software Industry).

The Slanic Salt Mine (1685) consists of 14 trapezoid-shaped rooms with a ten-meter ceiling and thirty and thirty-two-meter floor width. The mine is a tourist attraction and also a place where both visitors and patients are treated for various respiratory diseases.

This is the first church wholly painted by the great Romanian painter Nicolae Grigorescu, at the age of 18! He later became member of the famous Fontainebleau School.

From the Official Lunch of the Cultural Program. From right to left: Prof. Pavel Mach (Department of Electrotechnology, Czech Technical University in Prague, Faculty of Electrical Engineering, Czech Republic), Prof. Zsolt Illyefalvi-Vitez (Department of Electronics Technology, Budapest University of Technology and Economics, Budapest, Hungary), Prof. Dr. Feri Nemeth (Department of Electronics Technology, Budapest University of Technology and Economics, Budapest, Hungary)

UK:
Meetings Programme:
- Day with the Industry

The Day with the Industry or Vendors Day as it is known in the US, held in Swindon in September proved to be a success with 25 table top exhibitors with 52 attendees. The response both during and since the event has been very positive and plans for a repeat are being considered possibly being held in the Oxford area in June. Any prospective exhibitors should contact: peter.moran@ait-ltd.com

For details about the Chapter, please contact the IMAPS (UK) office at 4 The Close, Bracebridge Heath, Lincoln LN4 2PB. Tel: 01522 575212. Email: office@imaps.org.uk

Or check the web: www.imaps.org.uk
News from the Chapter:

All Change?

Attendees at the Microtech event in Cambridge this March will have looked forward with interest to the now established annual Market Watch session and will have been able to get some idea of what the future has in store. To us old lags in the industry the changes that have taken place are quite dramatic and unexpected. Those who have not responded to the changes will be facing difficulties either already or in the near future. With so much production lost to emerging lower cost facilities in Asia and Eastern Europe, can the UK hold onto at least the design and development aspects as suggested or will in time the very speed of the introduction of new products necessitate all aspects to be close at hand? Mobile Comms is an example where a recent DTI mission found China and Korea close on the heels of the UK. The latter may well be the case so new products in new markets with new process technology need to be found. The alternative is to be so good at the job that clients will not want to go elsewhere. It is interesting therefore to note a report from the organisers of the Medical Device Technology Conference and Exhibition who found that whilst 2003 saw the industry investing in capital - equipment, premises, e-commerce - the coming year expects 55% of respondents to be increasing their R&D budget, 56% increasing sales and marketing, 52% equipment and 51% design, all of which should provide a healthy increase in the market for 2006 and beyond. Two companies come to mind what were heavily involved in the Microelectronics industry for several decades which have found the Medical market for consumable items a worthwhile diversification - Wesley Coe and Batten and Allen.

In the UK Electronics Industry as a whole Electronics Manufacture and Test have found that in the last 12 months the number of companies expecting their workforce to remain the same or increase has risen from 2% to 93%: 79% rather than 70% expect an increase in turnover. More alarming however is that at the beginning of 2005 it seems 85% of companies will not yet have switched to lead free. This shortfall is not without support to help the conversion. For example Soldertec Global has introduced a new series of interactive CD-ROMS at £99 each and NPL has appointed Ling Zou as its Test Service Manager for its Lead-Free consultancy service.

Other diversions with potential seem to be the ever increasing automotive market, the almost infinitesimal market for sensors and now low frequency wireless. Welsh start-up DeepStream was recently in the news claiming to be the first company in the world to have the technology to produce digital sensors in £d packaging at low cost allowing the embedding of levels of measurement and control in electrical control systems as never seen before. Matlab and MathWorks are working together on the radar beam control for Jaguar’s cruise control system.

To close we include a statement recently made by Sir John Chisholm, CEO of QinetiQ, that UK engineering and technology companies must invest in training if they are to continue to compete in the global market. Haven’t we heard this before somewhere?

BCW
Global Business Council

Are you making the most of your corporate membership?

Michael P. O’Neill, Heraeus Circuit Materials Division, Chairman, Global Business Council (GBC), IMAPS, moneill@4cmd.com

In both their business and personal lives, individuals are involved in various societies or organizations. Churches, special interest groups, local and scholastic athletics, government related activities, trade organizations and technical societies offer many opportunities for service in the non-profit world. One’s participation ranges from leadership, actively participating, organizing, listening in during a monthly meeting or simply paying your dues and receiving the newsletters. Businesses also participate as corporate members in those organizations, and typically provide assistance in funding for operation of the organizations, lend credibility to the organization’s mission and give the particular business positive PR within the relevant area or local community. None of these organizations exist without the collective participation of the membership.

Most of us participate in such organizations in the manner in which we participate is guided simply by one’s behavioral style. Those with “driver” personalities tend to be leaders that work 24/7 and those with “expressive” behavior styles gravitate towards social activity. Amiable folks tend to be energized by teamwork and structure, while those with “analytical” styles live in world of data, and organization. The reality is that not all leaders are drivers, and those who analyze are not necessarily all accountants or engineers. But all of these behavior styles are those of your peers, and you deal with managing your own and others’ behavior every day. What behavioral style do you exhibit? Perhaps the way you participate in your company or related non-profit organization is guided by your individual behavior style. It’s worth some thought.

Why the discussion on behavior? Because your company, your family, and any organization you belong to is made up of people of various backgrounds and behaviors. And there is much to learn from all that diversity. The strength of one can complement an area of challenge for others. So let’s talk about your strength and how it can add to IMAPS!

IMAPS Corporate Membership comes with many benefits. Many of them are financial, with respect to discounts on events, advertising, etc. Your technical organization, through IMAPS, is plugged into the premiere society for the advancement of microelectronic and packaging technologies. And simply by purchasing a booth at the IMAPS annual symposium you become a corporate member - how easy! But for that person in your organization who writes the check for IMAPS Corporate Membership, I have a question - Do you take advantage of all the benefits of Corporate Membership? One of those benefits that is directed at you, the person with the budget, or you, the company owner: and even you, the leader of a particular business unit - is the Global Business Council (GBC). The GBC’s charter is directed to fulfill the needs of corporate membership. Are you getting the most out of the GBC?

The GBC’s activities are organized by a team of dedicated volunteers who exhibit the diversity of various behavioral styles. The GBC Steering Committee operates in a manner exemplifying our credo, the result of which is that we are always active, and always looking for ways to improve our product. But this is not enough. The GBC’s product, business events and dissemination of information from those events, cannot improve without constant participation from that diverse group of Corporate Members. What's in it for me? Well, I’ve heard business owners say “...I do not know what is going on out there, I leave it to Joe to tell me that...” or “...I have no time for events as I am trying to figure out a way to deal with my competition in overseas...” or “whatever happened to George? I used to call on him when I was doing what you do now - oh, he is President of one of our customers?!” You get the picture.

In conclusion I’ll again pose the title question - Are you getting the most out of your corporate membership? As you know most things we desire do not fall into our lap. We need to seek them out and judge if they are of value to oneself and/or the company. The value you take out of IMAPS and the GBC is proportional to the value you put in. So make it a point to attend at least one NEW GBC event this year. Get the most out of your corporate membership.

To see the GBC calendar of events and registration information, go to www.imaps.org/gbc.
**Henkel Donates $1.35 Million in Aid of Flood Victims**

**Immediate aid for victims of the flood disaster in Southeast Asia**

As immediate aid following the flood disaster in Southeast Asia, Henkel has pledged a cash donation of $677,000 (500,000 euros). In addition, Henkel is preparing to send clothing and hygiene products valued at $677,000 (500,000 euros).

“Henkel has endeavored to respond to this catastrophe by providing aid and assistance to the victims in as rapid and as non-bureaucratic a manner as possible,” explained Knut Weinke, Executive Vice President, Human Resources at Henkel KGaA.

Henkel in North America is the manufacturer of leading consumer and industrial brands like Loctite® adhesives, Dial® soap, Duck® brand duct tape, and Dep® hair gel.

**Mini-Systems Reaches GOLD Supplier Status**

Northrop Grumman Space Technology (NGST) has announced that Mini-Systems, Inc. (MSI), both Thick and Thin Film Divisions, have once again reached GOLD Supplier status based on quality and delivery. As addressed by NGST, “I must express my appreciation for Mini-Systems’ continuous dedication to excellent quality.”

MSI was awarded GOLD Supplier status, which is the highest level a vendor can reach with NGST, by ongoing efforts to supply excellent quality, repeated responsiveness and delivery performance. MSI was again one of only a few, out of over 1000, that have achieved this demanding goal.

**Palomar Supplies Optoelectronic and Complex Packaging Assembly Equipment to Fabrinet**

Palomar Technologies has announced an agreement to supply Fabrinet with opto-electronic and complex packaging assembly equipment to expand Fabrinet’s capabilities in volume assembly of terminal-active optoelectronic components and precision microelectronic packaging. Fabrinet is an engineering and electromechanical manufacturing services company specializing in the manufacture of complex assemblies.

Fabrinet will add a Palomar LDA Laser Diode Attach Component Assembly Cell and a Model 8000 high speed thermosonic ball and stitch wire bonder to its new manufacturing facilities in Bangkok, Thailand. The LDA will increase the quality, throughput, and yield of optoelectronic components manufactured by Fabrinet. Fabrinet will use the 8000 for wire bonding microelectronic packages, including most semiconductor-based interconnect applications such as hybrids and gold ball bumping.

In addition, through its Process Development and Prototyping Services, Continued on page 26
Palomar will qualify and develop processes on existing and emerging packaging technologies, ultimately transferring the processes to Fabrinet for production engineering, volume manufacturing, and supply chain management in Thailand.

“Fabrinet is one of a very few EMS companies anywhere in the world capable of the precision manufacture in high volume of complex components such as those in the optics, optomechanical, and optoelectronic industries,” said Bruce W. Huener, Palomar’s VP of marketing and business development. “Its location in Thailand is an added bonus because of the skilled labor force, stable government, and low cost of doing business there.”

“Our engineers have spent several weeks at Palomar becoming familiar with Palomar’s process development and equipment,” said Dr. Teera Achariyapaopan, Fabrinet’s executive VP & chief operating officer. “Adding the Laser Diode Attach assembly cell and 8000 wire bonder to our lines automates our process and allows us to offer our customers even more precision packaging options while reducing time-to-market, throughput, yield, and costs.”

Ken Kuang, IMAPS VP of Membership, Founded Torrey Hills Technologies, LLC

Torrey Hills Technologies, in conjunction with GTSGI China, has developed high quality low cost China OEM sources for various microelectronics packaging raw materials and components. Its mission is to help U.S.-based companies lower manufacturing cost and improve profitability by outsourcing to China.

Torrey Hills Technologies, LLC Forms Strategic Alliance with China Saneway Microelectronics Materials Co. Ltd.

Torrey Hills Technologies, LLC announces a strategic alliance agreement with China Saneway Microelectronics Materials Co. Ltd. for the development and worldwide marketing of high performance heat sinks.

“Saneway Microelectronics Materials Co. Ltd. is the leading China manufacturer of high performance heat sinks,” said Ken Kuang, President of Torrey Hills Technologies, LLC. “We are very pleased with the alliance with Saneway and are poised to provide high quality, low cost heat sinks to the international microelectronics packaging community.”

“We see this as a strategic opportunity to leverage our two companies’ complementary expertise. Combining Torrey Hills Technologies, LLC’s marketing expertise with Saneway’s high performance material capability, we are ideally situated to provide a full range of CuW, CuMo and Cu/Mo/Cu heat sinks to the international community,” comments Dr. Guosheng Jiang, General Manager of Saneway.

The initial products offered are CuW, CuMo and Cu/Mo/Cu heat sinks. A new generation of material Cu/CuMo/Cu laminate is being developed and is being sampled by a few key customers.

SatCon Electronics Achieves Class K Certification to DSCC MIL-PRF-38534

SatCon Electronics, Inc., a designer and manufacturer of high reliability electronic packaging products, recently received certification by the Defense Supply Center in Columbus, Ohio (DSCC), enabling it to build space-qualified products to the MIL-PRF-38534 Hybrid Microcircuit Class K. Class K is the highest reliability level achievable in the assembly of hybrids. SatCon Electronics has been a supplier of microelectronic devices for Class H applications for a number of years.

SatCon Electronics has supplied space level devices to one of its current customers for use in GPS satellites for about four years. In addition, SatCon Electronics’ acquisition of the Sipex data converter products in 2002, brought with it additional space-level Class K products, some of which are expected to be used for other space applications. SatCon Electronics undertook the challenge of achieving the Class K certification level in order to improve its product offerings and to respond to the new emphasis on increasing reliability across the board for all space and satellite applications.

Obtaining recognition of its process expertise, quality systems and documentation procedures has opened up a number of new markets to SatCon not previously available. With increased emphasis on telecommunications, worldwide media and satellite radio, more commercial space use is anticipated. The military is also increasing its emphasis on the more efficient utilization of this communication space to further integrate its network centric, cross-platform communication process as part of its mission statement to obtain better interoperability between the services, support its Future Combat Soldier program and improve battlefield management.

A total of 41 companies in the United States are qualified by DSCC to build hybrids. In achieving this award, SatCon Electronics joins an elite group of only 15 qualified to produce space level products. In addition, SatCon Electronics is ISO-9001 certified.

Indium Corporation Announces Silver Quill Award Winners

Indium Corporation of America recently awarded its annual Silver Quill Award for excellence in technical writing to two employees. The Silver Quill Award was developed to encourage and incentivize individuals for authoring technical reports, presentations, articles and books. Eligible individuals are awarded points throughout the year based on the number and quality of their written material or presentations, and the importance of the venue (regional vs. international).

Best Author, Mike Fenner

Mike was chosen for this award for his ability to take complex and fragmented information and make it useful and practical for the solder user. Mike’s papers include:

- “Constant Solder Volumes for Consistent Assembly, A Guide to Solder Preforms”
- “Understanding the Impact of Pb-Free on Solder Paste”
- “Extreme Soldering”
- “How to Choose & Implement a Solder Paste for Pb-Free”
- “A Comprehensive Strategy to Achieve Timely RoHS Compliance”

Best Paper, Tim Jensen

Tim’s paper, entitled “Solder Paste Evaluation Techniques to Simplify the Transition to Pb-Free,” removes the confusion around conducting a Pb-Free solder paste evaluation. This timely paper will support Indium’s customers in their move to Pb-Free.

Palomar Represents San Diego World Trade Center on Mission to Shenzhen and China Hi-Tech Fair

Palomar Technologies represented the San Diego high technology community as part of the San Diego World Trade Center (SDWTC) mission to Shenzhen and the China Hi-Tech Fair (CHTF) from October 12 - 17, 2004. The mission established relationships and informed top government, business, technology and educational leaders in China about business, technology, and educational resources in San Diego. In addition, Palomar was one of five companies to exhibit in the San Diego pavilion at the CHTF.

The China Hi-Tech Fair was celebrated in conjunction with the grand opening of the Shenzhen Convention and Exhibition Center. Approximately 450,000 people
attended the CHTF, the largest and most important trade show for imported technologies and products in China. Organized by Asia Desk of SDWTC, the delegation included California Lieutenant Governor Cruz Bustamante and San Diego State University President Dr. Stephen Weber.

Palomar's exhibit explained how the equipment it designs and manufactures is used to precisely attach the minute integrated circuit to a package that will then be attached to a circuit board. This initial connection is necessary to power electronic devices. Palomar's wire bonding, die attach, gold ball bumping, and automated assembly equipment is used in the semiconductor, optoelectronic, RF, photonic, wireless, microwave, automotive, aerospace, medical, and life sciences industries.

“...The show was far larger and more significant than I originally perceived,” commented Bruce Hueners, Palomar VP marketing and business development. “We used it as a base for our local representatives, American Tec, and captured several hundred sales leads from show attendees. Through the SDWTC and the participation of Lieutenant Governor Bustamante and President Weber, we had high level CEO meetings and access to heads of government and education from throughout Southern China and the Shenzhen area as well as local members of the U.S. Department of Commerce.”
Topical Workshop and Tabletop Exhibit on
Military, Aerospace, Space,
and Homeland Security:
Packaging Issues and Applications
(MASH '05)

Sponsored by
International Microelectronics And Packaging Society (IMAPS)
Everything in electronics between the chip and the system!

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http://www.imaps.org/mash
Sacramento Marriott Rancho Cordova
11211 Point East Drive
Rancho Cordova, CA 95742 USA
May 3 - 5, 2005

In our current environment where the focus is on military activities and homeland security, extensive work is being done to advance the state-of-the-art in high reliability electronics packaging. The technical program will expand upon the 1st two successful workshops and will focus on the latest military, aerospace, space and homeland security electronic devices, systems, and applications, with particular emphasis on design, fabrication, assembly, testing, and materials selection operations.

A Tabletop Exhibition will feature the state-of-the-art applications, products and services of these technologies.

Please visit http://www.imaps.org/mash to view the technical program, register to attend, and to reserve your booth space.
AMI Offers Fully Automated, High Speed RFID Screen Printers

AMI now offers fully automated precision screen printers for the RFID (Radio Frequency Identification) card and label manufacturing industry. AMI high speed screen printers optimize the precision and speed of RFID antenna printing using newly developed high performance inks. Low-cost screen printing of RFID antennas offers significant savings over commonly used, costly subtractive manufacturing processes.

AMI’s RFID printer models are available in either PC or PLC control versions accepting screens up to 20” x 20” in size. Advanced, computer controlled precision printers are fully programmable, using servo and performance motors for critical machine movements. These models are designed with precision X,Y,Ω screen registration alignment and incorporate a fixed vacuum print platen with an adjustable integrated web indexing mechanism.

Fully automatic high-speed web (reel to reel) configurations include printers, infrared dryers and loop control stations. Single or multiple RFID antennas can be printed in a single print stroke with production rates as high as 1800 strokes per hour. Semi-automatic, stand-alone printers for RFID printing process development are also available.

For more information, please call 908-722-7100.

Morgan Electro Ceramics Offers New Piezo Bimorph for Telecommunications Industry

Morgan Electro Ceramics (MEC), a leading manufacturer of electro ceramic products, including high voltage and RF capacitors, and microwave and piezoelectric ceramics, offers new piezo bimorphs for switches used in the telecommunications industry. MEC’s piezo bimorphs, unlike traditional electrical solenoids, do not create an electric field, ensuring a disturbance-free environment.

MEC’s piezo bimorphs use a carbon fiber, in place of a customary metal inner layer, that provides greater deflection and improved force, while improving performance and reliability by 20-30%. The piezo bimorphs also feature a safety electrode, which guarantees operation in harsh applications, especially where the components are stretched to the breaking point. MEC has also developed an optional humidity coating to ensure that warm, damp or humid environments do not affect performance. Additionally, as smaller products have become increasingly essential to industry, the piezo bimorphs are available in a range of sizes from 15 to 45mm length and 2 to 15mm in width, resulting in a maximum deflection of 3mm (peak to peak) and a force of 400mN.

For more information, please call 617-367-0100.

Henkel’s Multicore LF318 Solder Paste is a Consistent Performer Regardless of Climate and Environment

A lead-free solder paste offering outstanding resistance to humidity is being launched by the electronics group of Henkel. Multicore® LF318 is a halide-free, no-clean, pin-testable formulation that promises broad process windows for both printing and reflow. The product has been developed to appeal particularly to multinational manufacturers wishing to qualify a single solder paste that offers reliable, repeatable performance within the assembly environment, under any climatic conditions.

LF318 achieves a consistently high degree of coalescence upon reflow even after 72 hours at 27 Celsius and 80 percent relative humidity, and in testing to IPC ANSI/J-STD-005 and JIS-Z-3284 standards displays excellent resistance to slump. The main benefits of specifying LF318 are evident during printing and assembly: low paste wastage - the result of superior tack life and an open time greater than 24 hours - and resistance to component movement during high-speed placement, through its high initial tack force of 2.0g/mm².

Suitable for reflow in air or nitrogen, LF318 displays excellent solderability on a wide range of surface finishes, including Ni/Au, immersion Sn, immersion Ag and OSP copper. After reflow, only soft, non-stick, colorless residues remain, easing visual inspection and permitting reliable in-circuit testing without clogging test probes, even after many hundreds of tests following double reflow.

Multicore LF318 is classified ROL0 according to ANSI/J-STD-004, and available in lead-free alloys 96SC (SAC387) and 97SC (SAC305). For assembly processes that do not require the use of a lead-free solder paste but would benefit from similar humidity resistance advantages to those of LF318, a tin-lead version of the solder paste, Multicore MP218, is available with similar properties.

For more information, please call 626-968-6511, x 414.

Honeywell Introduces GKN Series Key Operated Safety Interlock Switches

Safety key operated solutions for OEMs provide product reliability and flexibility in a cost-effective package

Honeywell has announced the newest addition to its safety key operated product portfolio - the GKN Series safety key operated switches. The GKN Series provides the features industrial equipment manufacturers require for safety position detection of protective guards or doors in a reliable, cost-effective, industry standard package.

The GKN Series has positive opening safety contacts (meets IEC 60947-5-1 requirements) and double insulation (meets IEC 60947-5-1 requirements and global standard compliance). A standard offering of a choice of five switch contact configurations, including two configurations with three contacts, meets a wide variety of customer applications and requirements. The configurations with three contacts provide cost-effective safety monitoring when used in conjunction with a safety module.

The rotating head allows actuator engagement from the front, back or either of two top positions for a total of four different actuation entry points. “This feature makes the product easy to adjust in the field, as well as reduces the number of units customers must keep in stock,” explains Honeywell Product Manager Karl Gustafson. “The mechanically coded actuators minimize intentional tampering or defeat.”

The GKN Series provides a choice of three standard key actuators, including a flexible key actuator that allows for minor misalignment. The large internal wiring cavity reduces installation time. The switch’s compact size and light weight provide a valuable solution for applications where space is at a premium, and the low price provides a cost savings to the user, especially at high volume.

For more information on this new product series, visit call 800-784-3011 (reference code GKN).

JPSA Laser Announces UV Laser Micro-machining for Medical Device Manufacturing

J P Serel Associates (JPSA Laser) offers precision UV laser micromachining services - with micron-scale features and sub-micron tolerances - for a variety of medical device manufacturing applications. Typical applications include micro-fluidics, sensors, nozzles, micro-screens, particle traps, MEMS, MOEMS, micro-dicing, biosensors (lab-on-a-
JPSA Laser’s contract manufacturing facility houses state-of-the-art UV excimer and DPSS laser workstations. The applications laboratory is also equipped with a host of diagnostic equipment for laser process development and characterization. JPSA engineers have developed F2 laser, optics, calorimetry, and beam delivery technology, allowing JPSA to offer comprehensive testing of VUV optics and materials processing services at 157nm. Most of the JPSA laser systems are equipped with state of the art air bearing motion stages to ensure high precision and accuracy. JPSA Laser’s core capabilities include expertise in UV materials processing at 355nm, 351nm, 308nm, 266nm, 248nm, 193nm, and 157nm wavelengths; a fully equipped applications development laboratory staffed with Ph.D. laser scientists; JPSA’s contract manufacturing facility is ready to meet customer needs from prototype to high volume production.

For more information, please call 603.595.7048.
Welcome New IMAPS Members!
November/December 2004

First Time Membership Renewals...
Thank You for Your Support!
November/December 2004

We appreciate and know the importance of our members’ continued support of IMAPS and the microelectronics and packaging industries. Our members’ participation has enabled IMAPS to bring leading technical programs, workshops, courses, and symposia into the forefront of the industry and throughout the world. It is this consistent support that has helped IMAPS achieve its position as the world’s largest electronic packaging society. IMAPS member support increases the value of the society to the microelectronics industry and increases the value of the society to you and your fellow IMAPS members. Therefore, we have devoted this section to recognizing those individuals who have renewed their support to IMAPS for the first time, as they join us in advancing and expanding the use of microelectronics through the dissemination of information and the promotion of the values of the technology.
Membership Benefits

* JOBS Marketplace – included with IMAPS Membership
  o Resume posting – anonymous, if desired
  o Completely searchable job openings
  o Not just IMAPS – Links to many other appropriate job-search venues
  o Record keeping – your results and actions are recorded for you
  o Offers many state-of-the-art features of many expensive job search engines
  o At no extra charge to all IMAPS members!

* Discount on attendance at all IMAPS events
  o Automatic Annual Membership renewal when you attend the
    Annual Symposium as a Full Symposium Registrant

* Access to the On-Line IMAPS Industry Guide
  o The internet's most comprehensive listing of individuals &
    companies providing products & services to the microelectronic
    and packaging industry
  o Personal listing
  o Complete, searchable, access to the entire IMAPS database
  o Upgraded and enhanced, secure log-in procedure

* IMAPS Local Chapter Membership
  o Network in your own community
  o Technical presentations by local, national and international experts
  o Volunteer opportunities

* Access to Information
  o Subscription to Advancing Microelectronics Magazine
  o Access to the on-line Journal of Microelectronics and Electronic Packaging
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* E-Mail Forwarding service
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Join or Renew your dues on-line at www.imaps.org

The International Microelectronics And Packaging Society is the largest society dedicated to the advancement and
growth of the use of microelectronics and electronic packaging through professional and public education, the dissemination
of information (by symposia, conferences, workshops, and other efforts) and the promotion of the Society’s portfolio of
technologies. IMAPS currently has more than 5,000 members in the United States and more than 4,000 international
members.

IMAPS
611 2nd St., NE - Washington, DC 20002 * 202-548-4001 * Fax 202-548-6115 * www.imaps.org
## Chapter Contacts

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The International Microelectronics And Packaging Society (IMAPS) is sponsoring its Topical Workshop (TW) on Flip Chip Technologies, to be held June 20-23, 2005, at the Marriott Austin at the Capitol Hotel in Austin, Texas. This meeting is a continuation of the annual Flip Chip Workshop, now in its tenth year and showcases the latest developments in flip chip technology.

As in past years, the technical program will focus on leading edge advances in flip chip technology with particular focus in 2005 on the challenges of flip chip for Cu/Low-K, Pb-free (Green applications), new technologies, and lower cost. The national organization will hold a focused exhibition for suppliers who support the use of flip chip technology.

For more information, please visit www.imaps.org/flipchip
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