Next Month's Focus
SMT and Production

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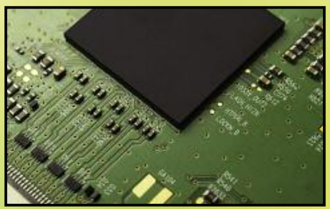
VOLUME 34 - NUMBER 3 — *THE GLOBAL HI-TECH ELECTRONICS PUBLICATION* — March, 2019

Product Preview: APEC



Low-voiding formulation joins Henkel's temperature-stable LOCTITE® GC solder materials portfolio. Product Previews begin on… *Page 74*

Para-Coat Protects Devices with Conformal Coating

Para-Coat Technologies specializes in Parylene coatings applied in a vacuum chamber. The resulting film is thin, highly conformal and can completely encapsulate a substrate. EMS section begins on… *Page 18*

This Month's Focus: Inspection and Test

Inspectis optimizes inspection through illumination; CAMI discusses misconceptions in cable testing; Koh Young delivers inspection feedback to boost printing and placement quality. Special Features begin on… *Page 58*

Hanwha Launches Modular Component Mounters at APEX

Cypress, CA — Hanwha, formerly Samsung C&T Automation, commemorated the induction of its HM520 modular component mounter at a ribbon cutting ceremony that took place Tuesday, January 29, at IPC APEX Expo in San Diego, California. The MH520 modular mounter was also given a prestigious NPI award at the show in the category of "Component Placement — High-Speed."

"Hanwha's HM520 advanced modular component mounter delivers industry-leading price-performance with unprecedented low costs of operation and ownership," commented Jonny Nichols, director of sales

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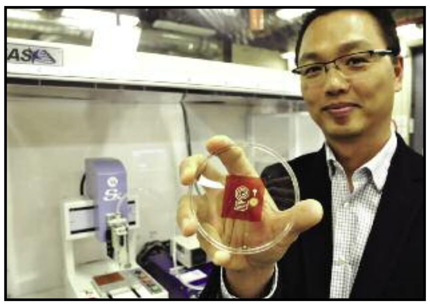
Jonny Nichols, director of sales and marketing — North America, Hanwha (center), gives a speech to celebrate Hanwha's brand-new HM520 modular component mounter.

Sustainable 3D-Printed Electronic IoT Sensors

Surrey, British Columbia, Canada — Simon Fraser University (SFU) and Swiss researchers are developing an eco-friendly, 3D-printable solution for producing wireless Internet of Things (IoT) sensors that can be used and disposed of, without contaminating the environment. Their research was published in the journal *Advanced Electronic Materials*.

SFU professor Woo Soo Kim is leading the research team's discovery involving the use of a wood-derived cellulose material to replace the plastics and polymeric materials currently used in electronics. Additionally, 3D printing can offer the flexibility to add or embed functions onto 3D shapes or textiles, creating greater functionality.

"Our eco-friendly 3D printed cellulose sensors can wirelessly transmit data during their life, and then can be disposed without concern of environmental contamination," says Kim, a professor in the School of Mechatronic Systems Engineering at SFU's Surrey campus. The research is being carried out at PowerTech Labs in Surrey, which houses several state-of-the-art 3D printers used by researchers.



Professor Woo Soo Kim holds an eco-friendly, 3D-printed circuit that uses a wood-derived cellulose material to replace plastics and polymeric materials.

"This development will help to advance green electronics. The waste from printed circuit boards is a hazardous source of contamination to the environment. If we are able to change the plastics in PCB to cellulose composite materials, recycling of metal components on the board could

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Keener Eyesight for Autonomous Vehicles

Cambridge, MA — Autonomous vehicles relying on light-based image sensors often struggle to see through blinding conditions, such as fog. But MIT researchers have developed a sub-terahertz-radiation receiving system that could help steer driverless cars when traditional methods fail.

Sub-terahertz wavelengths, which are between microwave and infrared radiation on the electromagnetic spectrum, can be detected through fog and dust clouds with ease, where the infrared-based LiDAR imaging systems used in autonomous vehicles struggle. To detect objects, a sub-terahertz imaging system sends an initial signal through a transmitter; a receiver then measures the absorption and reflection of the rebounding sub-terahertz wavelengths. That sends a signal to a processor, which recreates an image of the object.

But, implementing sub-terahertz sensors into driverless cars is challenging. Sensitive, accurate object-recognition requires a strong output baseband signal from receiver to processor. Traditional systems, made of discrete components that produce such signals, are large and expensive. Smaller, on-chip sensor arrays exist, but they produce weak signals.

In a paper published in the *IEEE Journal of Solid-State Circuits*, the researchers describe a 2D, sub-terahertz receiving array that is orders of magnitude more sensitive, meaning it can better capture and interpret sub-terahertz wavelengths in the presence of a lot of signal noise.

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Determining Wet Processing Parameters for MEMS, Nano Manufacturing and R&D

By Ed Sullivan

As the market for nanotechnology and MEMS solutions continues to ramp up, the rate of organizations seeking to get involved with this sector is also burgeoning. Yet, there are still significant challenges that are, in many cases, posing difficulties in entering this market.

For example, many developers who would like to enter the MEMS or nano field lack the resources, including development time and equipment, to do so. Also, specialized packaging in these areas, which requires simultaneous contact with its own environment while being isolated from other environments, is often expensive and difficult.

"MEMS research and manufacturing organizations are meeting those challenges in unique ways," says Louise Bertagnolli, president of JST Manufacturing, a specialist in wet processing equipment for the MEMS, nano, photovoltaic, wafer, and related industries. "An increasing number of universities and institutions offer the facilities, including equipment and instrumentation, to conduct MEMS and nano research and even produce prototypes and modest production runs."

Wet processing systems, one of the areas that organizations focus their attention on, are used for such procedures as etching, photoresist wet stripping, photolithography, metal lift-off, and related polymer removal processes.

JST Manufacturing's applications laboratory.

Those processes aid researchers and manufacturers in improving product quality and throughput in a wide range of MEMS and nano applications, such as microsensor- and microactuator-based devices.

Some of these capabilities are used in contemporary applications such as the screen rotation of today's cell phone displays and the optical switches and mirrors to redirect or modulate light beams. Future applications will provide complete "system-on-a-chip" capabilities.

Making Research More Available

Although the cost of MEMS and nano application development can be very expensive, some institutions are installing facilities and making them available to both educational and commercial researchers. The University of Michigan's Lurie Nanofabrication Facility (LNF) is one example.

Michigan's facility works in all areas of semiconductor device and circuit fabrication, integrated microsystems and MEMS technologies, nanotechnology, nanoelectronics, nanophotonics and nanobiotechnology. It is an open-use facility with hundreds of users from various departments, as well as many other universities and businesses.

According to Dennis M. Schweiger, senior director of infrastructure, soliciting the opinion of equipment manufacturers regarding equipment design for such facilities can be highly beneficial.

"It is important to our diverse users that we provide them with wet processing equipment that suits their purposes well due to the fact that we essentially rent the lab space and equipment needed," says Schweiger.

The original equipment design for the new lab area's wet processing benches was very specific and determined by the LNF staff. "When we first started out, we looked at it in terms of process flow and didn't take into account the variety and variation of

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Determining Wet Processing Parameters...

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process samples that our users might be working with. We hadn't considered how we'd accommodate non-standard sample sizes, or what the impact might be in total cost of ownership with respect to chemical usage," adds Schweiger.

In addition, some of the new equipment had its decks reconfigured once the tools were installed. Several of the earlier wet benches, some of which were purchased over 20 years ago, were also modified to allow for more flexibility in meeting the process needs of the user community

"Our initial plan for the deck space, and processing capability of the benches, wasn't flexible enough to properly serve our user community. We worked with JST Manufacturing to implement modifications so that the bench decks were simpler, and could provide more working space," Schweiger concludes.

"Although there are similarities in the wet processing techniques used to create a broad variety of MEMS and nano devices, each process might not be identical in concentration, time, temperature and chemicals used," Bertagnolli explains.

As a result, there are a wide variety of equipment designs available that include process modules for solvents, acid, bases, deionized water rinse and drying. Mechanical, ultrasonic or megasonic agitation as well as high-pressure spraying and other processes may also be incorporated, if needed.

Another consideration is safety and there are many mandated requirements for items such as ventilation, fire suppression, chemical handling and explosion prevention.

Equipment Design Modification

With the rapid growth of the MEMS and nano markets, many manufacturers are turning to automated equipment to increase throughput and ensure process repeatability. Fully automated process equipment often includes multiple stations or modules as well as robotics, sophisticated control, data logging and monitoring systems.

The design of many wet processing systems is proprietary; therefore specs are protected by the equipment manufacturer, as well as the user. Considering all of the design variables, it is wise to visit an equipment manufacturer with design capabilities and an application laboratory.

JST Manufacturing has an applications laboratory at its facility where users can develop their process with various chemistries and conduct tests on the actual equipment (including immersion, spray tools and dryers). The laboratory includes sophisticated metrology equipment including a scanning electron microscope and a Tencor particle counter.

By visiting such labs, end users can determine and optimize their processes, and minimize the amount of chemicals required as well as determine the tool features they need for their applications. This can save the customer money by eliminating features they do not need.

"Even though a manufacturer arrives with a good idea how they want to handle the wet processing, we are often able to recommend modifications after we have a chance to review the project," says Bertagnolli.

"Sometimes design variations will perform the cleaning or etching work in the manner required, but will also save money, reduce the floor space requirement, simplify maintenance or provide other benefits," she adds.

Determining Parameters

Many users insist on a standardized approach with customizable features that will best handle their applications parameters, in order to facilitate the economical design and building of a wet processing equipment solution.

Using SOLIDWORKS 3D-modeling software, a company such as JST can make minor modifications to meet the needs of each application. The equipment is modular by design, allowing for easy changing and reconfiguration should the process or product requirements change. This is a big advantage to users looking to have standard equipment with slight modifications.

Each component is designed with software that is capable of performing every possible tool function, including those that are not required. This type of custom work enables end users the ability to create their own process, or chemical recipes, with all sub-routines at their disposal.

"Even though users may not need some of the features today, it's possible that they may want to utilize them in the future for other applications, which can be both economical and powerful. This added flexibility in the programming of their equipment enables them to determine custom chemical concentrations to be used at a later date depending on their process requirements," says Bertagnolli.

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