New Welding Process Holds Potential for Medical Uses

Microfabrication developer Primoceler (Tampere, Finland) has created what it calls the world’s first sapphire-to-sapphire welding process that can be used in the manufacture of sensors, lenses and many other devices.

The cost-effectiveness, durability, high melting point, chemical inertness, transparency and capacity for optical transmission make sapphire highly suitable to many industrial applications. “At Primoceler, we constantly expand technological boundaries,” said Ville Hevonkorpi, Primoceler’s managing director. “We were the first to weld glass to glass, glass to silicon, and now sapphire to sapphire. Sapphire-to-sapphire welding is even more difficult than glass-to-glass welding.”

With its resistance to heat and chemical erosion, sapphire substrates currently are being used in the manufacture of LEDs for mobile handsets, television, auto headlights, and general lighting. “Now that we have developed this totally new technology, we’re anticipating that it will open new possibilities for industries, just as our glass-glass welding technology did,” said Hevonkorpi.

Medical applications for the use of sapphire abound. As an optical material, its durability is second only to diamond; sapphire also is chemically inert and non-thrombogenic, so it won’t cause blood clots, making it an excellent material for use in surgical tools, medical implants, and braces, as well as endoscopes and laser windows, according to the company. Primoceler’s prior developments include a laser welding process that produces very little heat-affected zone (HAZ) and expands the market for packaging of fragile components, including under or inside glass, said Hevonkorpi. To date, Primoceler has successfully applied its technology in welding glass to glass for medical applications, he added, and sapphire also holds potential for use in medical devices.

“Sapphire is widely used in sensors, different types of lenses and other devices, so there is a range of potential for this new technology,” said Hevonkorpi. “Companies that use sapphire for their products will come to us with ideas of how sapphire-to-sapphire welding technology can benefit them. We always welcome customers to challenge us and test their products.”

A new welding machine developed by Primoceler for the new sapphire process is similar to its laser-based welding system that produces a small HAZ. The new machine contains a fiber laser unit optimized for the welding process by Corelase (Tampere, Finland). The system includes in-house developed software and components, and it can weld a wide range of materials including glass, silicon and sapphire.

For more information, visit www.primoceler.com or e-mail info@primoceler.com. ME

Small Jaws Yield Strong Grip Force

A new machine tool vise-jaw design puts an unbreakable grip on only 3.5 mm of material to allow aggressive five-axis machining for aerospace and medical applications.
OML's (Italy) SinterGrip vise jaws, available exclusively in the US and Canada from importer Lexair Inc. (Lexington, KY), are designed to work primarily with OML's MC and Genius vises in applications where all but 3.5 mm of the workpiece is held above the vise, giving access for machining with short cutting tools for high-rate metal removal in one setup.

These vise jaws generate their strong grip through serrated carbide inserts that penetrate the workpiece edge to a minimal, controlled depth to exert downward force on the part. Thin parts are said to be machined without deformation by clamping them at 6600 lb (29.4 kN) of force to achieve penetration, then lowering the force to 2200 lb (9.8 kN) with no loss of grip. The jaws also can grip as well holding only 2 mm of the part surface, if required by the application.

The SinterGrip jaws and toothed, carbide inserts secure the part by creating two types of push-down effect on it. Each jaw features a series of triangular dovetailed pockets across the top edge into which the serrated carbide inserts are placed, secured by screws. The carbide inserts themselves have two rows of engineered teeth that penetrate the workpiece and produce push-down effect all their own. The pyramidal teeth are cut with a sharper angle on the lower edge than on the upper edge, causing the teeth to exert a push-down force on the workpiece.

Inserts placed in the vise jaw can be varied, with dummy insets available to fill the unused pockets. Penetration of the teeth is minimal and is always inversely proportional to the number of inserts used, but is typically well under 0.02” (0.5 mm) at 8818 lb (4000-kg) clamp force. Available in widths up to 8” (200 mm), the jaws can be installed on most vises with mechanical, mechanical/hydraulic or hydraulic clamping systems. For more information on OML workholding solutions, visit Lexairinc.com or call 859-255-5001. ME

Copper Mirrors for Lasers

Laser Research Optics (Providence, RI), a division of Meller Optics Inc., has released a new line of gold-plated copper mirrors for Mitsubishi high-power lasers.
The mirrors are manufactured with >99% pure gold deposited on oxygen-free high-thermal conductivity (OFHC) copper and are offered in three plano types—zero phase shift, 90º phase shift, and 98.8% resonator mirrors. The OEM-quality mirrors have 1/20 power flatness, 1/40 irregularity at 10.6 µm, and surface quality of <5 nm RMS and 40-20 scratch-dig.

Available immediately in 50, 60, and 76-mm diameter sizes with ±0/-0.12-mm tolerance, the copper mirrors for Mitsubishi lasers are suitable for beam bending in all beam paths and beam guidance systems, from simple measurement setup to high-performance cutting, according to the company, priced from $149.95 each. For more information, visit www.laser-research.net or call 888-239-5545.

**Semiconductor 450-mm Transition Highlights New SME Tech Papers**

Papers on 450-mm wafer technology, reverse engineering and pneumatic gaging were recently added to the nearly 18,000 offerings in SME’s Technical Paper series. All papers are available by entering the paper number or a keyword in the search box at www.sme.org/techpapers.

Kelly E. Davis’ paper (number TP-13PUB46) describes the economic pressures and industry challenges in the transformation to 450-mm semiconductor wafers. He highlights the predictive and preventive systems integrated into a flexible facility to adapt to changing requirements and technologies.

“Applications of Reverse Engineering in Manufacturing Industry” (TP-13PUB48) by Wego Wang discusses the
phases of decoding the original design details with programmatic analysis and reproducing an “identical” counterpart. The most challenging technical tasks in both phases are related to manufacturing processes because the history or trials of many manufacturing processes are erased in the final product.

In TP13PUB47, Michel Dechape updates a 1976 paper by V.R. Burrows on the principles and applications of pneumatic gaging. Pneumatic gaging—controlling the supply of compressed air to a system and using simple flow or pressure indicators to display the dimensional relationship between a nozzle and a workpiece—served industry admirably before electronic gaging became a reliable and economical workshop system. Patented advances in electronic converters make air gaging more valuable than ever, allowing linear measurements over a range four times that of previous systems, easier tooling design and machining, less air consumption, operation with no adjustments or maintenance and precise and repeatable regulation and measurement (micron inch resolution).

Metrology Research

The science of precise measurement was represented at the recent NAMRC41-MSEC 2013 advanced manufacturing conference. Two MSEC papers were presented by authors from Carl Zeiss IMT’s US and German offices. Marcin Bauza and Hubert Lettenbauer describe the advantages and challenges of the migration of computed tomography (CT) from medical (qualitative) applications to industrial (quantitative) metrology. CT provides unique information on the metrological aspects of complex structures and inaccessible features in applications ranging from consumer products to electronics, automotive, aircraft and medical. Bauza, Christopher Cilip and Daniel Pratt also investigate visual inspection of freeform glossy surfaces using phase-shifted deflectometry. Phase deflectometry also provides a means to validate prototype parts and fully optimize their processes before final implementation into manufacturing.
A NAMRC paper by Suresh Kumar Ramasamy (Hutchinson Technology, Carver, MN) and Jayaraman Raju (University of North Carolina-Charlotte) looks at multiscale data fusion as a cost-effective tool to measure and characterize new engineered surfaces for microelectromechanical systems (MEMS) and microfluidics. A performance study was conducted on a wide range of surface samples, and it was shown that Regional Edge Intensity (REI) is the preferred fusion method for surface metrology datasets, and Regional Energy (RE) is the second preferred method, when single-scale performance metrics are considered. This paper is in press for the Journal of Manufacturing Systems (http://tinyurl.com/NAMRC-Raju).

A laser Doppler vibrometer (LDV) based technique to accurately measure the radial error motions of a miniature ultra-high-speed spindle is the subject of a NAMRC paper by Sudhanshu Nahata, K. Prashanth Anandan and O. Burak Ozdoganlar of Carnegie Mellon University (Pittsburgh). The validity of the multi-orientation implementation is concluded from the fact that the artifact form error obtained at the two spindle speeds (50 krpm and 80 krpm) was nearly the same, with the radial spindle error motions being considerably different.

All NAMRC41 papers are available on the Proceedings of NAMRI/SME CD ($150; $100 for SME members), http://tinyurl.com/NAMRC41 ME.

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