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EV Group Brings out Revolutionary Layer Transfer System – December 13, 2023

EV Group Brings out Revolutionary Layer Transfer System
EV Group (EVG), a leading supplier of wafer bonding and lithography equipment for the MEMS, nanotechnology and semiconductor markets, has introduced the EVG®850 NanoCleave™ layer release system. This is the first product platform to feature EVG's revolutionary NanoCleave technology.

The EVG®850 NanoCleave™ layer release system
Specifically, the EVG850 NanoCleave system enables nanometer-precision release of bonded, deposited or grown layers from silicon carrier substrates. It uses an infrared (IR) laser coupled with specially formulated inorganic release materials in a proven, high-volume-manufacturing (HVM) capable platform. As a result, the EVG850 NanoCleave eliminates the need for glass carriers. Thereore, it enables ultra-thin

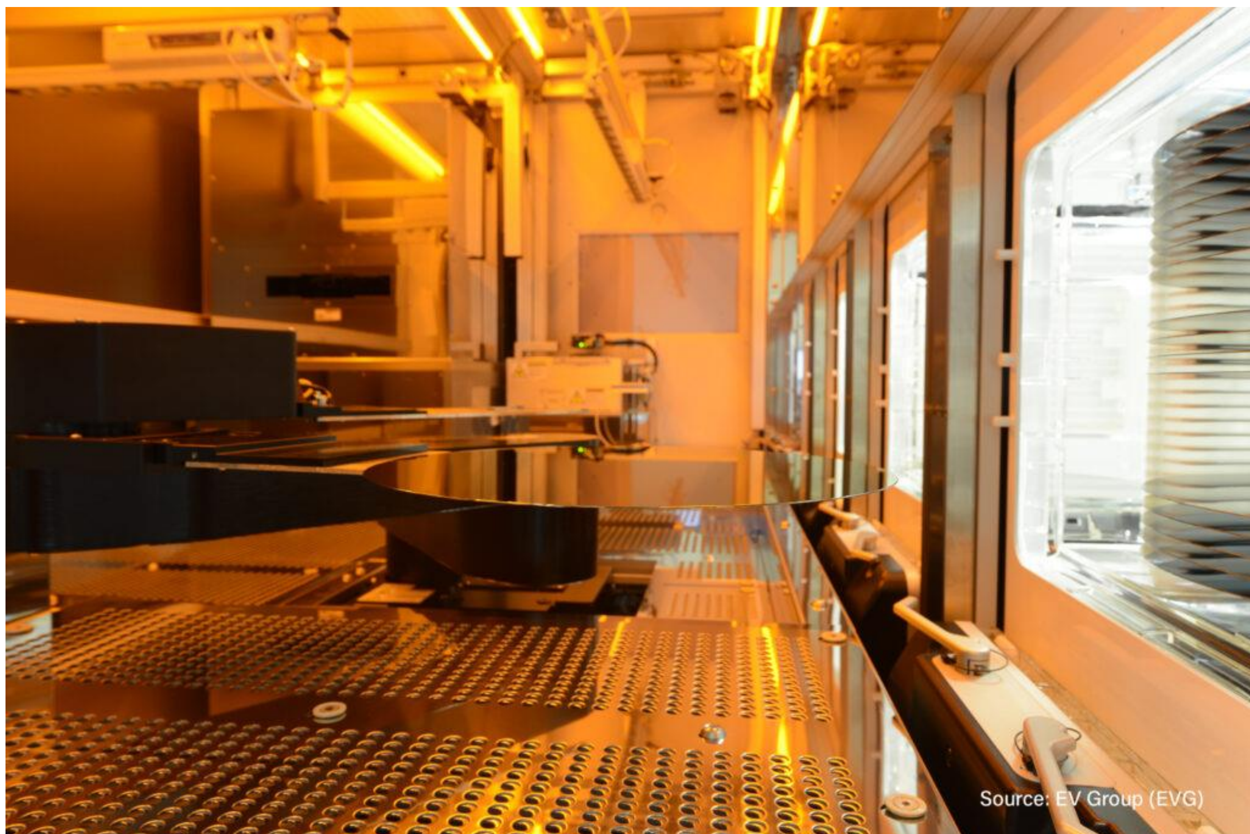
chiplet stacking for advanced packaging and ultra-thin 3D layer stacking for front-end processing. These include advanced logic, memory and power device formation, to support future 3D integration roadmaps.

The first EVG850 NanoCleave systems have already been installed at customer facilities. Nearly two dozen product demonstrations are underway with customers and partners at customer sites and EVG's headquarters.

Silicon Carriers Benefit 3D Stacking and Back-end Processing

In 3D integration, glass substrates have become an established method for building up device layers through temporary bonding with organic adhesives. It uses an ultraviolet (UV) wavelength laser to dissolve the adhesives and release the device layers. Subsequently, they are permanently bonded onto the final product wafer. However, glass substrates are difficult to process with semiconductor fab equipment that have been designed primarily around silicon. This requires costly upgrades to enable glass substrate processing. Generally, organic adhesives are limited to processing temperatures below 300°C. This limits their use to back-end processing.

Enabling silicon carriers with inorganic release layers avoids these temperature and glass carrier compatibility issues. In addition, the nanometer precision of IR laser-initiated cleaving allows for processing extremely thin device wafers without changing processes of record. Subsequent stacking of such thin device layers enables higher-bandwidth interconnects and new opportunities to design and segment dies for next-generation, high-performance devices.



View inside the EVG®850 NanoCleave™ layer release system

Next-generation Transistor Nodes Require Thin-layer Transfer Processes

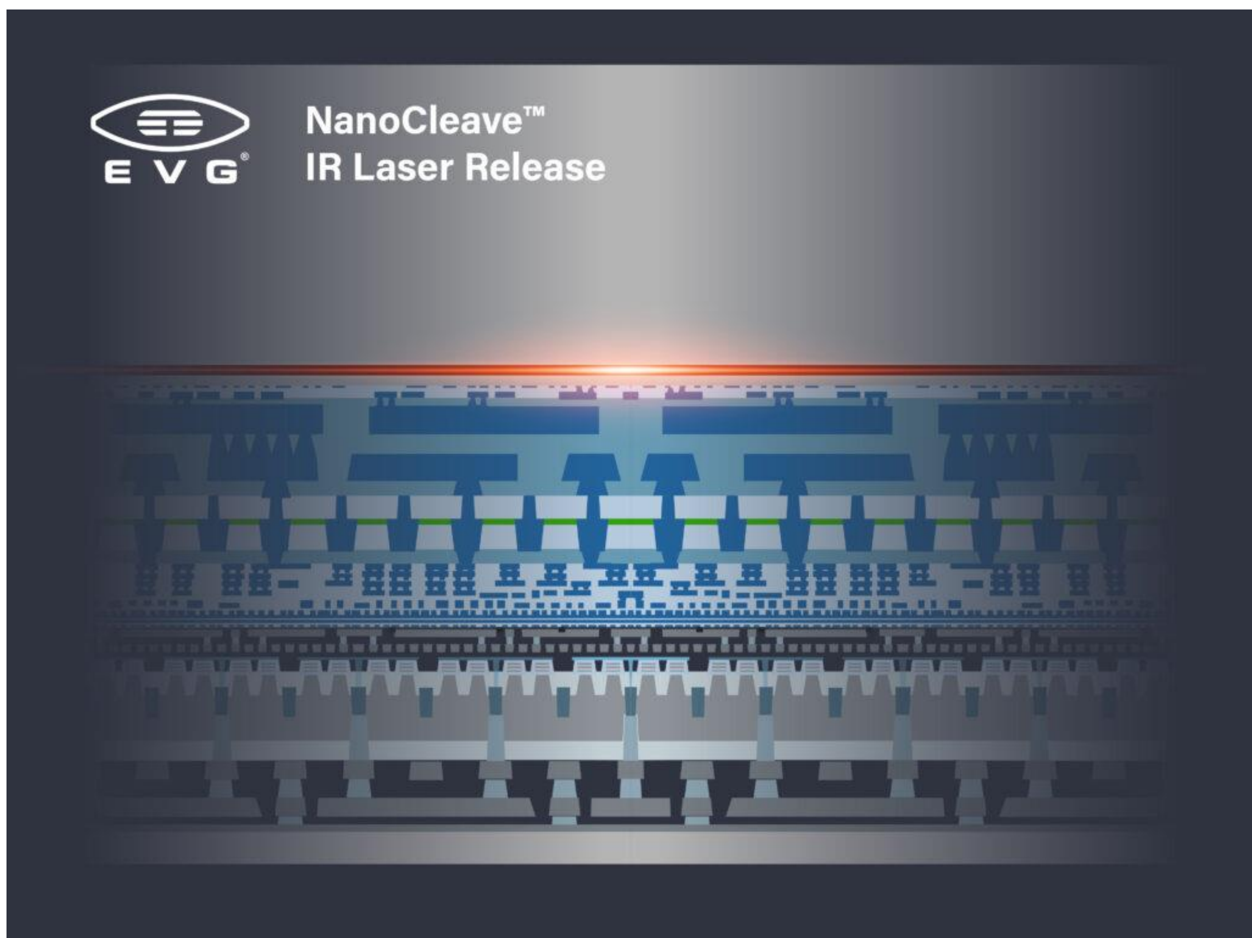
At the same time, transistor roadmaps for the sub-3-nm node call for new architectures and design innovations. Among them include buried power rails, backside power delivery networks, complementary

field-effect transistors (CFETs) and 2D atomic channels. All of them require layer transfer of extremely thin materials. Silicon carriers and inorganic release layers support process cleanliness, material compatibility and high processing temperature requirements for front-end manufacturing flows. However, until now, silicon carriers had to be completely removed using grinding, polishing and etching processes. Specifically, this process results in micron-range variations across the surface of the working device layer. Thus, this makes this method unsuitable for thin-layer stacking at advanced nodes.

“Releasable” Fusion Bonding

The EVG850 NanoCleave utilizes an IR laser and inorganic release materials to enable laser cleaving from silicon carriers with nanometer precision in production environments. The innovative process eliminates the need for glass substrates and organic adhesives. Thus, it enables front-end process compatibility for ultra-thin-layer transfer and downstream processes. The EVG850 NanoCleave’s high-temperature compatibility (up to 1000°C) supports the most demanding front-end processing. Meanwhile, the room-temperature IR cleaving step ensures device layer and carrier substrate integrity. The layer transfer process also eliminates the need for expensive solvents associated with carrier wafer grinding, polishing and etching.

Additionally, the EVG850 NanoCleave is based on the same platform as EVG’s industry-leading EVG850 Series of automated temporary bonding/debonding and silicon-on-insulator (SOI) bonding systems, with a compact design and HVM-proven wafer handling system.



EV Group’s revolutionary NanoCleave layer release technology

According to Dr. Bernd Thallner, corporate R&D project manager at EV Group, “Since EVG’s founding more than 40 years ago, our vision has been steadfast in being the first in exploring new techniques and

serving next-generation applications of micro- and nanofabrication technologies. Recently, 3D and heterogeneous integration have stepped into the spotlight as key drivers of performance improvements on new semiconductor device generations. This in turn has brought wafer bonding front and center as a critical process for continuing PPACt (power, performance, area, cost and time-to-market) scaling,"

"With our new EVG850 NanoCleave system, EVG has merged the benefits of temporary bonding and fusion bonding into one versatile platform supporting our customers' ability to extend their future roadmaps in both advanced packaging and next-generation scaled transistor design and manufacturing."

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