INNOVAVENT®

Semiconductor Laser Annealing

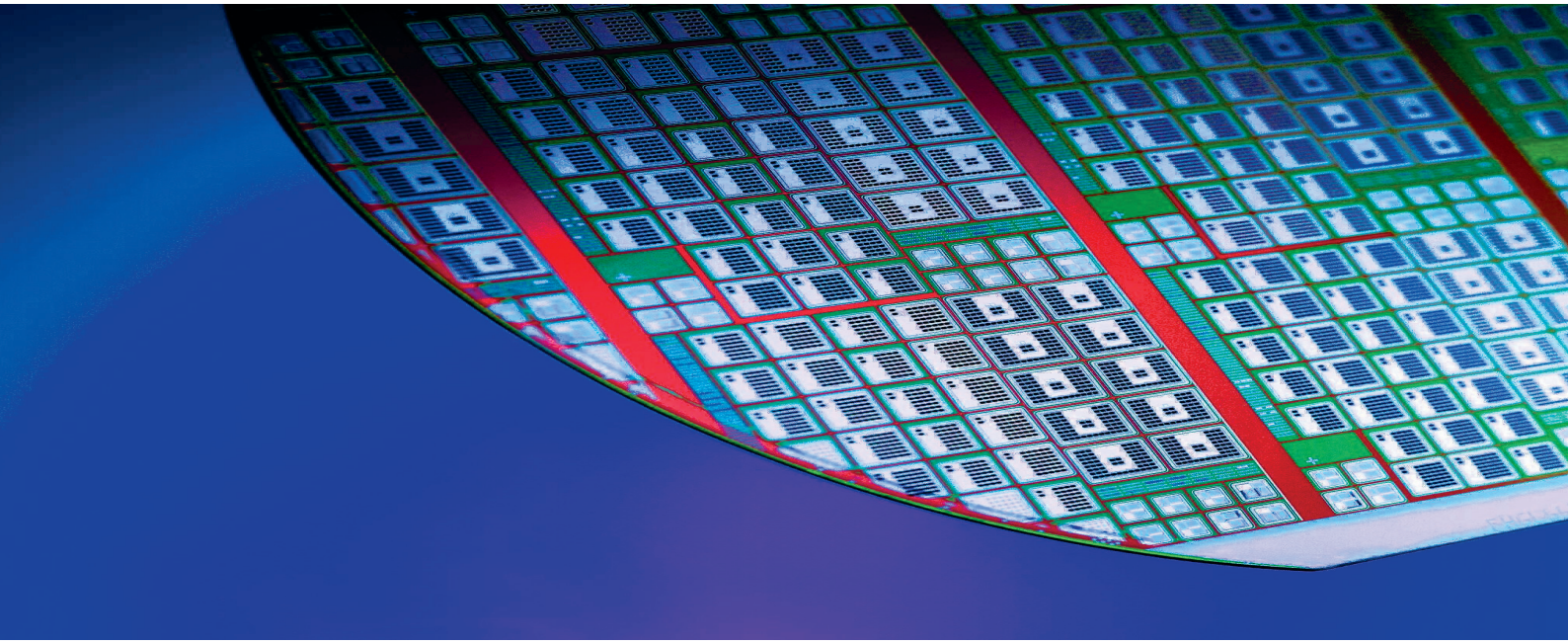


Photo: IGBT wafer, courtesy Fraunhofer Institute for Silicon Technology (ISIT), Itzehoe, Germany

INNOVAVENT® LASER OPTICS

operated by JenLas® **ASAMA** Thin Disk Laser

Semiconductor Laser Annealing

Pulsed Laser Annealing of Power Devices and Backside Illuminated Image Sensors

Power transistors like IGBT´s are manufactured on thinned wafers. To improve the ON resistance, wafer thickness is constantly reduced. Handling of these wafers is becoming more and more challenging. Solutions for manufacturing are wafer bonding to stable support carriers or the so-called TAIKO® technique (DISCO Corp., Japan) which stabilizes thin wafers mechanically. Organic materials are often used in both methods and prohibit using high temperature furnace processes for dopant activation.

The way out of this dilemma is the implementation of pulsed laser annealing. Short pulses in the range of 1µs or less allow achieving the required process temperatures on the exposed surface and simultaneously avoiding excess temperature levels on the other surface.

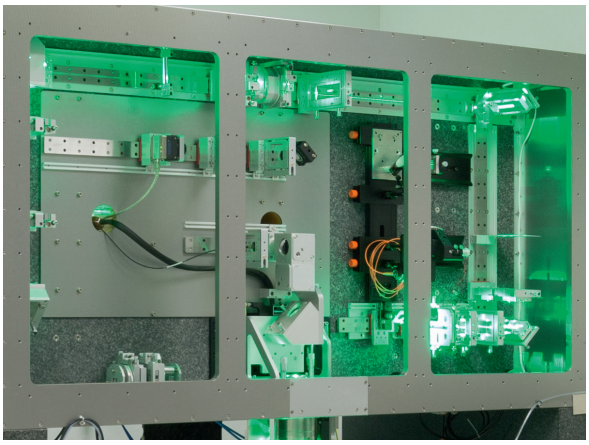
For **power semiconductor devices** which have metal contacts on the front side, pulsed laser annealing is an enabling process. The front side can be fully processed, including metal contacts, and the back side is subsequently annealed using pulsed laser radiation. Short laser pulses keep the temperature on the front side low and the metal contacts intact.

Backside illuminated image sensors are another example which benefit from pulsed laser annealing. A shallow implant layer on the surface can be activated while keeping buried structures like sensors and metal contact layers fully intact.

The INNOVAVENT Pulsed Laser Annealers

The **INNOVAVENT VOLCANO semi** annealers are available with a single wavelength pulsed green laser for activation depths of up to 2µm and in a dual wavelength version with a combination of infrared and green lasers for activation up to 3.5µm depth. Both systems offer a unique flexibility due to independently variable pulse durations of both lasers, IR and green. Various other parameters like laser intensity and scan speed can be widely adjusted for precise process optimization. Processing of different semiconductor devices can be optimized easily by selecting pre-programmed recipes.

Variants of the **VOLCANO** annealers for other applications like contact formation on SiC wafers are available as well.



INNOVAVENT VOLCANO semi IGBT system

	VOLCANO semi IGBT	**VOLCANO semi IGBT Dual Wavelength**
application	shallow and medium depth dopant activation, SiC contact formation	dopant activation beyond 2µm
wafer size	depending on wafer handler	
wavelength	515nm	515nm and 808nm
laser line size	3.5mm x 30µm	
process duration (pulse length)	300ns - 1200ns	300ns - 1200ns (515nm) 10µs - cw (808nm)
energy density/power density	variable, up to 5J/cm²	variable, up to 5J/cm² (515nm), variable, up to 50kW/cm² (808nm)
pulse repetition rate	10kHz	

INNOVAVENT GmbH
Bertha-von-Suttner-Str. 5
37085 Göttingen, Germany
phone: +49 (0) 551 90047-0
fax: +49 (0) 551 90047-19
www.innovavent.com
info@innovavent.com

North America
phone: +1 415 800 4848
www.innovavent.com
infousa@innovavent.com

Japan
OPTOPIA Co., Ltd
611 West Tower
Kanagawa Science Park
3-2-1 Sakato, Takatsuku, Kawasaki
Kanagawa, Japan, 213-0012
phone/fax: +81 44 812 5911/21
www.optopia.co.jp, sales@optopia.co.jp

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