JENOPTIK

Laser Doping of Crystalline Solar Cells

Crystalline Solar Cell Panel.
Fernando Tomás, Creative Commons License

INNOVAVENT® LASER OPTICS
operated by JenLas® **ASAMA** Diode Pumped Thin Disk Laser

Laser Doping of Crystalline Solar Cells

Laser Doping

With the strongly enhanced worldwide programs to develop and support solar energy, technological developments to increase the efficiency of cells and to lower production costs simultaneously come more and more into the focus of the industry. Despite the efforts to develop thin film cell concepts, using silicon thin film or other materials, crystalline cells will keep a large market share in the coming years. The efficiency of these crystalline cells depends strongly on the rate of charge extraction and on low-ohmic contacts.

In order to optimize charge extraction and contact losses, doping of the cells to create high-efficiency pn-junctions and low resistance contact fingers becomes a critical task, especially in the view of low-cost production methods at large area production volumes. Simple furnace doping suffers not only from large energy consumption, but makes it very difficult and thus expensive to create localized areas with high dopant concentration for contact fingers. Laser and optics technology allow easily to concentrate laser light to selective areas on the wafers and thus to achieve low resistance contact areas while optimizing the pn junction with low dopant concentrations for efficient charge carrier generation by the sunlight.

When very thin wafers as 150µm are used, laser doping presents a method which avoids wafer breakage and increases production yield, compared to diffusion furnaces.

The VOLCANO solar Laser Doping System

The INNOVAVENT VOLCANO solar laser system uses the proprietary JenLas® ASAMA thin disk laser. It is designed to generate highly uniform laser beams to scan the wafer surface. Besides the high uniformity, the JenLas® ASAMA laser allows to vary the pulse duration over a wide range. The variability of energy density and pulse duration allows to control depth and temperature of the activation process very precisely. The homogeneous beam intensity leads to high process stability and uniformity. The VOLCANO solar laser system does not use phosphorous acid.

Optical beam splitter technology, specially developed for laser doping processes of solar cells, allows to dope selectively the areas of contact fingers with very high precision and high throughput. Cells covered with a layer of a dopant precursor can be doped directly by the laser radiation. Cells which have been pre-doped in a furnace can be treated with a multi-spot laser beam to activate the dopants below the contact finger to a very high rate, in order to lower the contact sheet resistance to 40 ohm/square or less.

The flexible VOLCANO solar laser systems together with the JenLas® ASAMA laser technology enable INNOVAVENT to customize the laser doping process for different cell designs, so that the efficiency enhancement can be maximized by simultaneously minimizing investment and operation costs.

	VOLCANO 80/160 solar
wavelength/nm	515
laser power/W	80 or 160
laser line size and shape	single line 7-100mm x 10µm or multi-spot arrangement
process duration/ns	300 - 1200
energy density/J/cm²	variable, up to 7

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

Asia: OPTOPIA Co., Ltd.
phone: +81 44 812 5911
www.optopia.co.jp, sales@optopia.co.jp
USA: Jenoptik Laser Technologies
phone: +1 248 446 9540
www.jenoptik.com/lm