

Trade Press Release

Shanghai, China, May 15, 2013

Heraeus Photovoltaics Introduces Two New Pastes for Lightly Doped and Ultra Lightly Doped Emitter Cells at SNEC

- **Customers have choices with Heraeus to select best LDE paste for their manufacturing process and product design**

The Heraeus Photovoltaics Business Unit, a worldwide leading supplier of metallization pastes for solar cells, will launch two new front-side metallization pastes for standard to ultra-lightly doped emitter cells - the SOL9620 Series and SOL9621 Series - at the SNEC (2014) International Photovoltaic Power Generation Conference & Exhibition from May 20th through May 22nd, 2014. Heraeus will be exhibiting in Hall W3 at booth 560.

The SOL9620 Series and SOL9621 Series enables cell manufacturers to further improve their c-Si cells' conversion efficiencies to an industry-leading level. By using these new pastes, customers have confirmed efficiency improvements that ranged between 0.05% and 0.20% absolute on lightly doped emitter [90 – 100 Ω /sq.] wafers, relative to the best commercially available front-side pastes. Even greater gains have been achieved on ultra lightly doped emitter [110 Ω /sq.] wafers, where the paste unfolds its peak performance.

The SOL9620 Series and SOL9621 Series of pastes are able to provide excellent contact on lightly doped emitters [LDE]. The SOL9620 Series is outstanding for ultra-lightly doped emitters [ULDE], with surface doping concentrations down to $1 \times 10^{20}/\text{cm}^3$. "The SOL9620 Series also has the ability to be fired at a peak temperature 15 K less than standard firing temperatures. This is ideal for PERC applications. The SOL9621 Series has demonstrated great results for LDE applications. The SOL9621 Series provides customers with a flexible process window, which aids in providing a lower manufacturing cost" explains Dr. Weiming Zhang, Vice President of Technology of the Heraeus Photovoltaics Business Unit. He continues to state, "The reduced contact resistance on LDE und ULDE wafers helps yielding increased voltage and higher cell efficiencies. When optimized in a customer's manufacturing process, both pastes provide excellent performance."

"Heraeus has always been a leader in the development of innovative metallization pastes for solar cells. We are launching two products for slightly different LDE applications that provide industry leading cell efficiencies while lowering customers' cost per watt. Having two products allow customers to select the paste that is best for their cell design and manufacturing process", according to Andreas Liebheit, Global Manager of the Heraeus Photovoltaics Business Unit. He continues to state, "The acquisition of the Ferro PV Paste Business in 2013 is enhancing our research and development capabilities and growing our intellectual property portfolio. We have improved our ability to provide our customers with new metallization paste options for a variety of cell design applications."

The SOL9620 Series, the SOL9621 Series, our advancements in paste technology and other topics can be discussed at Heraeus Photovoltaics' celebration event at our booth on Tuesday, May 20th from 3:30pm – 5:30pm at this year's SNEC 8th (2014) International Photovoltaic Power Generation Conference & Exhibition, in Shanghai China at Hall: W3 Booth: 560. You can also go to www.pvsilverpaste.com for more information about our products and selected research presentations.

About the Heraeus Photovoltaics Business Unit

The Heraeus Photovoltaics Business Unit is an industry leading developer and manufacturer of silver metallization pastes for the photovoltaic industry. For over 40 years, Heraeus has built a reputation of innovation, extensive research and new product development in thick film technologies for some of the most prominent companies within a variety of industries. In the field of photovoltaics, the Heraeus Photovoltaics Business Unit applies this history and its innovative technology to offer metallization pastes for solar cell applications. The Heraeus SOL Series of silver pastes is specially formulated to provide higher efficiencies and wider processing windows, resulting in better yields and higher output for cell manufacturers.

The Hanau-based precious metal and technology group Heraeus is a globally active family-run enterprise with a history of more than 160 years. We provide high-end solutions to our customers to lastingly strengthen their competitive position. Our areas of competence include precious metals, materials and technologies, sensors, biomaterials and medical devices, quartz glass and specialty light sources. In the financial year 2013, Heraeus achieved revenues from the sales of products of €3.6 billion, while the revenues from precious metal trading were €13.5 billion. With about 12,500 employees in more than 110 companies world-wide, Heraeus is in a leading position on its global sales markets.

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