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Collaborative Project

SIKELOR

Project title:	**Silicon kerf loss recycling**
Project coordinator:	**Helmholtz-Zentrum Dresden-Rossendorf e.V. Germany**
HZDR participant:	**Institute of Fluid Dynamics**
Project homepage :	http://www.sikelor.eu/
Starting date:	**01.11.2013**
Duration (months):	**36**

Summary

Solar energy direct conversion to electricity is expanding rapidly to satisfy the demand for renewable energy. The most efficient commercial photovoltaic solar cells are based on silicon. While the reuse of feedstock is a severe concern of photovoltaic industry, up to 50% of the valuable resource is lost into sawdust during wafering. Presently the majority of silicon ingots are sliced in thin wafers by LAS (loose abrasive sawing) using slurry of abrasive silicon carbide particles. The silicon carbide is not separable from the silicon dust in an economical way.

The newer FAS (fixed abrasive sawing) uses diamond particles fixed to the cutting wire. It is expected that FAS will replace LAS almost completely until 2020 for poly/mono-crystalline wafering. The intention of the proposed project is to recycle the FAS loss aiming at a sustainable solution. The main problem is the large surface-to-volume ratio of micron size silicon particles in the kerf loss, leading to formation of SiO_2 having a detrimental effect on the crystallisation.

The compaction process developed by GARBO meets the requirements of a reasonable crucible-loading factor. Overheating the silicon melt locally in combination with optimized electromagnetic stirring provides the means to remove SiO_2. The technology developed by GARBO removes the organic binding agents, leaving about 200 ppm wt. diamond particle contamination. If untreated, the carbon level is above the solubility limit. Formation of silicon carbide and precipitation during crystallisation is to be expected.

The electromagnetic mixing, in combination with the effective means to separate electrically non-conducting silicon carbide and remaining SiO_2 particles from the silicon melt by Leenov-Kolin forces and the control of the solidification front, is the proposed route to produce the solar grade multi-crystalline silicon blocks cast in commercial size in a unified process.

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