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A high-speed crystal orientation mapping system for multi crystalline silicon solar cells

A new XRD system built by GE Sensing & Inspection Technologies utilizes a 100-year old technique - Laue X-ray diffraction - but applied in a new state-of-the-art way to the problem of determining the orientation of large-grained (> 5mm^2) multi-crystalline silicon solar cells. The single grains for the positions of the Laue shots are identified by optical recognition. A random degree of misorientation between the grains are undesired and may lower the efficiency of solar cells made from such materials. One goal of advanced crystallization is the evolution of selected orientations of grains on a wafer surface, which must be measured on the entire wafer area. Thus the solar industry has strong need for a system that can provide such crystallographic information from a complete silicon solar wafer mapping on e.g. 500 grains in less than 2 hours, enabling the industry to optimize their production process for solar wafers and control the production output. Prior to the development of this system, such orientation mapping was performed using monochromatic theta-2theta scans, which on average took 2 days to extract the relevant crystallographic information or by electron back scatter diffraction technique which can only utilize small samples in a scanning electron microscope chamber.