PRESS News

ISRA VISION

Release:	No. 590, May 24, 2016
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Crack Detection for Maximum Cost Efficiency in Wafer Production

Early Detection of Cracks in Wafers Increases Productivity and Reduces Costs in Solar Cell Production

The solar wafer is at the heart of the solar cell. But before it can be transformed into a cell, and later into a module, it receives a number of demanding treatments. This begins with sawing the silicon brick into wafers, which are only 100 to 200 µm thick, and is followed by mechanical influences in handling, processing and transportation. Small cracks in the core or on the edge of the wafer will grow due to the impact of these processes and during diffusion or firing due to thermal or mechanical stress. What started out as a micro defect can cause a final wafer to break – resulting in sunk costs for invested time, material and efforts.

Even though cracks in wafers can expand greatly in size, they often are quite hard to detect. This holds true especially in the early stages of processing, before they extend through thermal treatments or mechanical handling. In addition, on multicrystalline wafers, cracks don’t differ much from grain boundaries. Common optical inspection systems will not increase the contrasting of these defects, despite using infra-red transmission or bright field illumination.

As manufacturers of wafers and cells produce diamond wire cut wafers, thorough crack detection becomes increasingly important and more difficult. The new cutting technology allows for a more efficient use of the silicon material and enables very thin cut wafers. A disadvantage of this: thinner wafers may break even faster. Beyond

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that, the diamond wire cut wafers are harder to inspect, as the sharp cutting results in a very even and glossy surface with a strongly anisotropic reflection behavior.

Reducing the possibility of wafer breakings during processing is crucial, not only for a high-yield wafer production. As a broken wafer may damage the printing screen or pollute it with small particles, damaged screens need to be cleaned or even replaced immediately. This results in higher costs for material and forces the production line to stop. The downtime per breaking event is around 10 to 30 seconds, adding up to a huge loss in the long run, as it affects the entire production process.

ISRA VISION / GP SOLAR developed a new concept of detecting these micro cracks in their earliest phase. Through an innovative combination of illumination, camera setup and software, the patented solution achieves high detection rates and low false rejects with an accuracy of below 1 µm on mono and multi crystalline wafers as well as diamond wire cut material. Thus, detecting cracks with the NANO-D already in the micro stage saves machine time, material, consumables and production capacities and pushes the total output of wafer and cell production. Simple integration reduces effort and costs for automation suppliers, while providing faster commissioning time. This brings the system productive in very short time and enables a fast return on investment for the customer.

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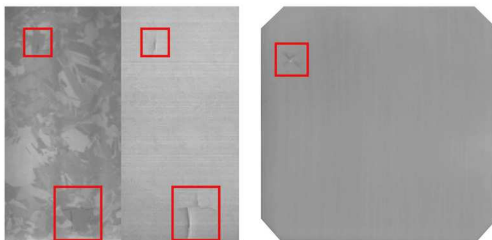
Images



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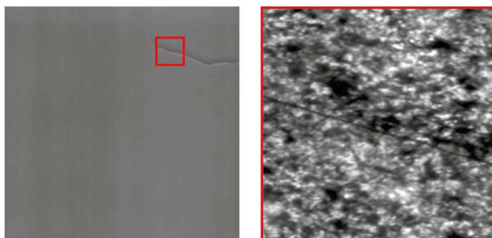
Grain boundary suppression by patented technology for crack detection on multicrystalline wafers (left).
Detection performance on diamond wire cut (DWC) wafers (right).



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Comparison between NANO-D micro crack image (left) and microscope image (right): detection of the same crack < 1 µm.

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