Micro Crack Detection of Multi-Crystalline Silicon Solar Wafer Using Machine Vision Techniques

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Abstract

It is not easy to detect invisible micro cracks of multi-crystalline silicon solar wafers because of their heterogeneously textured backgrounds. The difficulty is twofold. First, invisible micro cracks must be visualized to imaging devices. Second, an image processing sequences capable of extracting micro cracks from the captured images must be developed. To solve the problems, we first set up a near infrared imaging system to capture images of invisible micro cracks. After being able to see invisible micro cracks, a region-growing-based flaw detection algorithm was developed to extract micro cracks from the captured images. The experimental results showed that the proposed micro cracks inspection system is effective in detecting micro cracks. Besides, it is also applicable to inspect silicon solar wafers for stain, pinhole, inclusion, and macro crack. The overall accuracy of the defect detection system is 99.85%. The advantages afforded by the system including excellent crack detection sensitivity, ability to detect hidden subsurface micro cracks, and low cost.

Keyword：Micro Crack, Flaw Detection, Region Growing, Solar Wafer, NIR Imaging