**Area:** Advanced wire sawing.

**INVESTIGATION OF SURFACE DAMAGE CAUSED BY DIAMOND WIRE IN CRYSTALLINE SILICON THIN WAFERS**

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The present study mainly focuses on to investigate subsurface damage caused by multi-wire sawn monocrystalline silicon photovoltaic (PV) wafers with a thickness of 120 µm. In slicing silicon bricks into 120 µm thick monocrystalline silicon wafers, diamond abrasives with a diameter of 6 to 12 µm fixed on core steel wire with a diameter of 100 µm are employed [1]. The slicing with diamond abrasives fixed on a wire seriously scratches front and backside surfaces of the wafer, damages the wafer subsurface and forms amorphous silicon (a-Si). In this study, wafers were labelled as fresh wire side and worn-out wire side. After slicing, the as-sawn wafers underwent slight KOH etching (-1 µm). Nondestructive measurement such as micro-Raman spectroscopy was employed to detect the presence of a-Si. Surface profile of an as-sawn wafer is shown in Fig. 1(a), which contains terraces and a row of elliptical craters. Miro-Raman spectrum measured using 100X microscope excited with 532nm laser. The penetration depth of laser beam is almost 800nm. The Raman signal measured at terrace contains broad signal from 400-600 cm⁻¹ region, the characteristics peaks in this region normally associated with crystalline, microcrystalline, and amorphous silicon. The sharp peak at approximately 520 cm⁻¹ can be attributed to the crystalline silicon and broad peak at 470 cm⁻¹ can be attributed to a-Si [2]. The Raman spectrums of as-sawn and KOH-etched wafers are shown in Fig. 1(b) and (c). For as-sawn wafers, Raman signal measured at a terrace has a broad a-Si peak and the intensity of the amorphous phase in fresh wire side wafers is larger than that in worn-out side wafers. While the a-Si of worn-out side wafers is completely removed by KOH etching, that of fresh wire side wafers is not but double-peak feature was observed. Raman signal measured at the bottom of craters in all wafers shows sharp peak at 521 cm⁻¹, indicating the presence of the monocristalline phase. This work provides slight KOH etching completely remove a-Si from worn-out side wafers but cannot from fresh side wafers.

![AFM image of as-sawn a wafer containing terraces and a row of craters. (b) Raman signal measured at a terrace of an as-sawn wafer, (c) Raman signal of an as-etched wafer measured at a terrace, and (d) Raman signal measured at a crater.](image)

**Figure 1:** (a) AFM image of as-sawn a wafer containing terraces and a row of craters. (b) Raman signal measured at a terrace of an as-sawn wafer, (c) Raman signal of an as-etched wafer measured at a terrace, and (d) Raman signal measured at a crater.

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**Reference:**