High lateral resolution energy dispersive X-ray spectroscopy and cathodoluminescence on lamellae of CIGSe solar cells.

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Details

Abstract

The spatial resolution of conventional measurement geometries for energy dispersive X-ray spectroscopy and cathodoluminescence is limited by the excitation volume. For $Cu(In,Ga)Se_2$ solar cells high acceleration voltages up to 30 kV are needed to excite the K-shell of the investigated elements. As a consequence, the expansion of the excitation volume is in the magnitude of the layer thickness. Hence, thin lamellae were prepared with a focused ion beam and thinned out to a specimen thickness down to 50 nm. As a result, the spatial resolution was increased up to 25 nm, because the excitation volume is limited by the thickness of the lamellae and in first approximation only depends on the diameter of the electron beam. Highly resolving EDS measurements were performed to determine the gallium profile in the $Cu(In,Ga)Se_2$ absorber and the expected behavior was verified. Furthermore, cathodoluminescence images were taken of the lamellae and the determined grain structure was compared with the structure measured via scanning transmission electron microscope.

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