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Fast and Accurate – Novel Crystallographic Orientation Mapping by Raman Microscopy

We introduce a novel method of quantitative Raman Imaging for Crystal Orientation analysis (qRICO) that is capable of performing fast and simple to use orientation mapping of materials through an innovative realization of Raman microscopy and image reconstruction. The method inherently allows to investigate large sample surfaces with no sample preparation requirements and high flexibility for sample geometries, with the extension to map into sample depth non-destructively. Its results are truly quantitative and in correspondence with established electron and x-ray techniques.
By using a concept of ambiguity-free orientation determination reconstruction in combination with a novel polarized Raman microscopy approach, we present a fast and quantitative single-acquisition Raman-based approach [1], which simultaneously registers multiple Raman spectra at different polarizations and allows for both 2D and 3D quantitative orientation mapping. The method applies to all Raman active materials independent of crystal symmetry and involves no sample preparation. Fundamentally inherent to our approach is the ability to investigate large sample areas in a short amount of time, while altogether not being restricted by any sample environment requirements or sample geometrical extent.
Going beyond mere fundamental demonstrations of the approach, we have developed a commercially available solution, which enables routine quantitative Raman Imaging of Crystallographic Orientation (qRICO) for the non-expert user in any laboratory setting for simple and fast acquisition of orientation maps.
We will present an overview and detailed introduction into the fundamentals of the underlying approach and demonstrate qRICO performance on a selection of applications cases including polycrystalline semiconductors, polycrystalline ceramics, solar cells and pharmaceutical tablets (see Figure 1).

References

[1] O. Ilchenko, Nat. Commun. DOI:10.1038/s41467-019-13504-8.

Figures

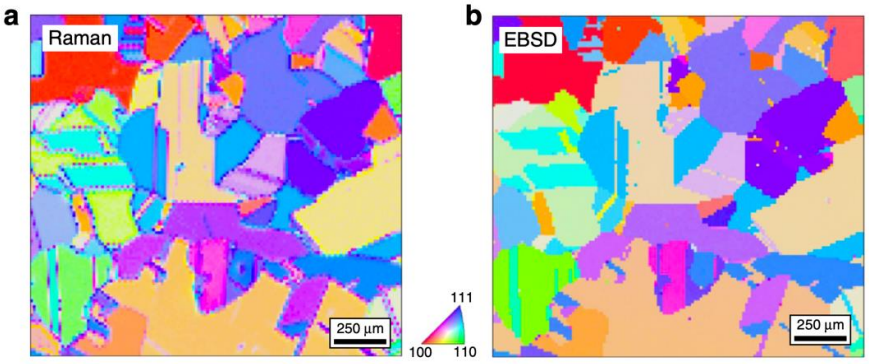

Figure 1: Quantitative orientation mapping example of poly-crystalline Si solar cell by (a) novel Raman microscopy and for reference in (b) standard EBSD.