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2D and 3D crystallographic orientation mapping using qRICO

Non-destructive orientation mapping is a crucial tool in the characterization of polycrystalline materials and helps improve material properties based on the microstructure. Confocal Raman microscopy proves to be a highly effective non-invasive method for chemical mapping of organic and inorganic material. Polarized Raman microscopy (PRM) can be used as a tool for crystallographic orientation mapping, since Raman peak intensity is defined by crystal symmetry and its local crystal orientation [1]. This technology does not require a large amount of sample preparation such as scanning 3D X-ray diffraction or electronic back scattered diffraction (which can also alter the microstructural properties in some cases).
Quantitative Raman Imaging for Crystal Orientation (qRICO) analysis by means of PRM [2] is a non-destructive, cost-effective, and fast characterization technique for 2D and 3D orientation mapping of polycrystalline materials. The basic idea involves the simultaneous measurement of Raman scattering at different combination of incident and scattered polarization. The theoretical spatial resolution of the orientation map obtained by qRICO is constrained by the diffraction limit. In the present study, we demonstrate different applications of the qRICO technology (2D and 3D mapping of polycrystalline germanium and sapphire samples) and discuss possible methods to increase the spatial resolution mapping using chemometric techniques.

References

[1] R. Loudon, Advances in Physics, 13 (1964) 423.
[2] O. Ilchenko et al., Nature Communications, 10 (2019) 5555.

Figures

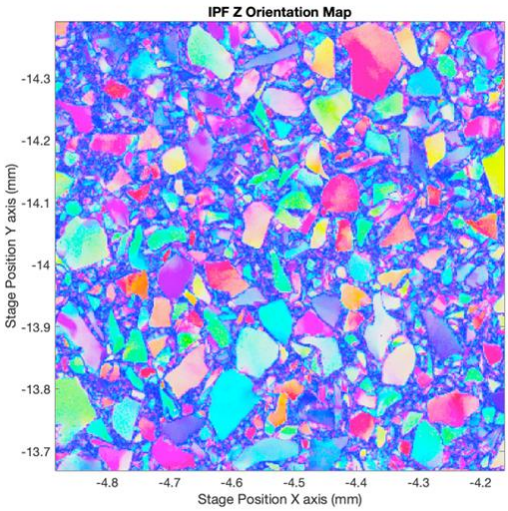

Figure 1: Color coded IPF map of polycrystalline germanium.