Combining texture, structure, microstructure and phase analyses for multiphase bulks and thin films diffraction characterisation: some case studies, Bi2223, $Ca_3Co_4O_9$, PCT, irradiated FAp and nano-Si.

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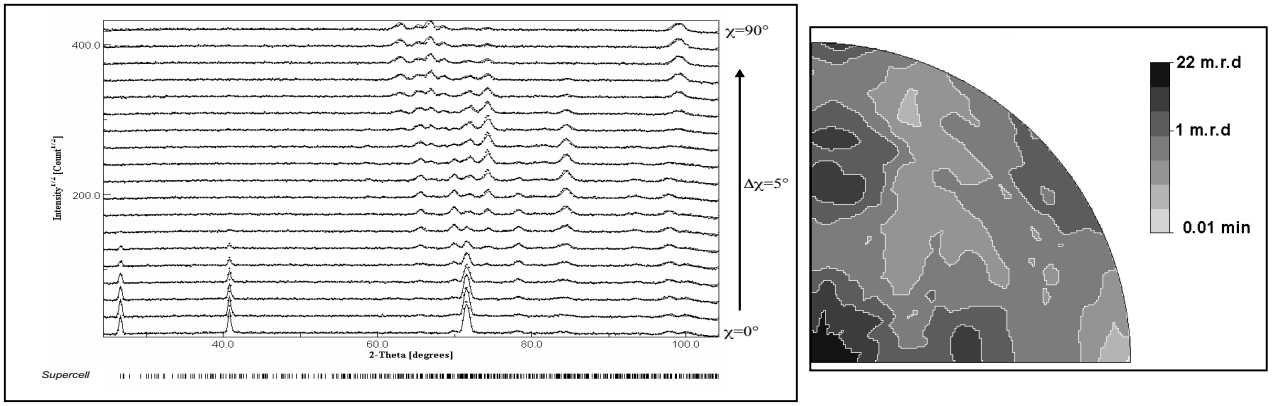
The controlled development of texture in polycrystalline materials appears to be more and more essential in ceramic and thin film processing, since potential applications require materials with macroscopic properties comparable to the intrinsic anisotropic tensors of the crystal structures. Texture analysis is consequently recognized as a really important tool in the characterisation of oriented samples. Since phase, structure, texture, stresses, microstructure signatures are simultaneously observed in the diffraction diagrams, they all are biasing each others and prevent single analyses (i.e. phase determination) to be carried out without taking account of all the signatures (i.e. structure determination of a textured sample). To overcome this problem, the combination of Rietveld, WIMV and Popa approaches, for instance as implemented in the MAUD software (Materials Analysis Using Diffraction), permits a comprehensive new approach to crystal structure-texture-microstructure-phase-stress analysis. In this study, we report the application of this method to different ceramic materials with different textures, crystallographic structures, microstructures …. Orientation distributions (OD) were determined from neutron and X-ray diffraction using curved position-sensitive detectors (D1B (ILL) & INEL CPS 120). We demonstrate here the efficiency and reliability of iterative combination of algorithms for structure-phase determination (Rietveld), microstructure (Popa) including layering and OD calculation (WIMV) in the case of oxide ceramic and thin film materials, and of silicon nanostructured films.



Example of combined analysis fit for the Co349 modulated structure of an oriented ceramic and corresponding inverse pole figure for the pressure direction