

Location of interstitial Cr in mullite by incoherent channeling patterns from characteristic X-ray emission

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ABSTRACT

The use of a direct crystallographic technique is reported for locating Cr atomic sites in a mullite containing 11.5 wt% Cr₂O₃ by monitoring variations in characteristic X-ray emission rates as a function of fast electron beam orientation. Systematic examination of two dimensional incoherent channeling patterns (ICP), formed from characteristic X-ray emissions from Al, Si, and Cr, and recorded near low index zone axis orientations, has enabled the preferred lattice position of Cr in mullite to be identified as the interstitial site 0, 0.25, 0. Although the method of atom location by channeling enhanced microanalysis (or ALCHEMI) generally has been applied in situations where introduced minority atom species are accommodated in substitutional atomic positions, this study illustrates the identification of an interstitial site of an introduced dopant species. This result does not coincide with that derived from X-ray Rietveld refinement. The ICP method is analytically robust and, unlike Rietveld refinement, does not require a highly accurate model of the host lattice framework and composition. ICP analysis therefore may be more appropriate for this particular application.