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Optic properties of centimeter-sized crystals determined in air with the spindle stage using EXCALIBRW

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Abstract

Extinction data sets for four centimeter-sized anisotropic crystals were collected in air with standard spindle-stage methods and submitted to a new Windows-based version of EXCALIBR, termed EXCALIBRW. EXCALIBRW solved these data sets with varying degrees of accuracy related to the external shape of the crystal: the more rounded the crystal, the more precise the results. For an olivine crystal ground into a sphere, the results were similar to those obtained for a crystal immersed in an index-matching fluid. However, even for samples bounded with growth or cleavage faces, the program determined the orientation of the optical indicatrix and 2V with an error of only 1–2°. Thus, this logical extension of spindle-stage methods is helpful: (1) to orient centimeter-size single crystals for various types of mineralogical measurements (e.g., spectroscopy or diffusion studies in which it might be undesirable to place the sample in a liquid); (2) as a non-destructive means of identifying gemstones based upon a determination of their optical class (i.e., isotropic vs. uniaxial vs. biaxial); and (3) for optical characterization by determination of 2V. In addition, the newest version of EXCALIBR is easier to use, mathematically more robust in its solution algorithms, and provides solutions for crystals in less favorable orientations than the earlier versions of EXCALIBR.