Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.35660

The crystal structure of ruby at megabar pressure

DR. BARBARA LAVINA

University of Chicago & Argonne Natl. Laboratory

Ruby, chromium-doped corundum, might very well be the second most critical material in high-pressure experimental science after diamond. The most widely used pressure gauge [1,2] is based on the pressure and temperature dependence of ruby's fluorescence. Al_2O_3 is also used as window material in shock compression, as pressure medium and insulator in micro fabricated sample chambers. Just as important, is to understand the deformation mechanisms of the prototypical structure - common to many sesquioxides and other 2:3 compounds- and of AlO_6 octahedra - critical building blocks of minerals in a wide range of conditions. It is therefore not surprising that a great deal of work has been dedicated to the experimental and computational determination of ruby's properties under pressure, with the greatest accuracy possible [3].

We obtained an accurate assessment of the behavior of the material at ambient temperature in its metastable pressure range, above 80 GPa. A small ruby sphere was compressed in helium in a diamond anvil cell and its long range ordering was probed using synchrotron single-crystal micro-diffraction. We improved greatly from previous measurements [4] with better resolution and sampling of the reciprocal space. Bulk and axial compressibility data will be compared to the literature. Robust single-crystal structural refinements were obtained at about 80 and 127 GPa, settling any lingering controversy on the bonding response of ruby under pressure.

Our data provide much improved experimental observations, offering tighter constraints on modeling the behavior of ruby under pressure.

[1] Mao et al. (1978) J Appl. Physics 49 (6). [2] Shen et al. (2020) High Press. Research 40, 3, 299-314. [3] Syassen (2008) High Press. Research, 28, 2, 75-126 and references therein. [4] Dewaele and Torrent (2013) Phys Rev B, 88, 164107.