American Mineralogist, Volume 100, pages 1528–1532, 2015

Effect of crystal defects on diamond morphology during dissolution in the mantle

Alexander F. Khokhryakov[1,2,*] **and Yuri N. Palyanov**[1,2]

[1]Novosibirsk State University, 2, Pirogov str., Novosibirsk, 630090, Russia
[2]V.S. Sobolev Institute of Geology and Mineralogy, Siberian Branch of Russian Academy of Sciences, 3, Koptyug Pr., Novosibirsk, 630090, Russia

Abstract

The influence of three-dimensional defects on the morphology of diamond dissolution in water-containing carbonate melts was studied at a pressure of 5.7 GPa and a temperature of 1300 °C, using a BARS multi-anvil apparatus. Experiments on stage-by-stage dissolution were performed for four blocky synthetic diamond crystals. Initial crystals had polycentric structure of the faces, strong strains, block structure, numerous microtwins, and microinclusions. It has been established that the main relief features of partly dissolved diamond crystals are shield-shaped laminae and negative trigons on remnants of {111} faces, deep etch channels, rectilinear steps on microtwins, and hillocks on rounded surfaces. The produced dissolution forms have shagreen or block-type rounded surfaces. The main element of the relief are hillocks. Their shape is controlled by the orientation of the surface on which they are localized. For natural rounded diamonds it is found that the dissolution drop-like hillocks on the surfaces are also related to strong lattice strains occurring in the crystals. The established relation between the dissolution hillocks and diamond deformation can be used for the reconstruction of the post-growth history of natural diamonds as well as for the preliminary evaluation of their quality.

Keywords: Diamond dissolution, crystal morphology, defect of crystals, dissolution hillocks