Almost epitaxial forsterite in nanometer-sized K-rich fluid/melt inclusions of Aykhal diamond

S.L. HWANG[1]*, P.SHEN[2], T.F.YUI[3], H.T. CHU[4], A.M. LOGVINOVA[5], N.V. SOBOLEV[5]

[1]Dept. Materials Sci. & Eng., Nat'l Dong Hwa Univ., Hualien, Taiwan, ROC (*slhwang@mail.ndhu.edu.tw)

[2] Dept. Materials & Optoelectronic Sci., Nat'l Sun Yat-sen Univ., Kaohsiung, Taiwan, ROC

[3]Central Geo. Survey, P.O. Box 968, Taipei, Taiwan, ROC

[4]Inst. Earth Sci., Academia Sinica, Taipei, Taiwan, ROC

[5]Inst. Geol. & Mineral. of SB RAS, Novosibirsk, Russia

The crystallographic orientation relationships of forsterite precipitates within the nanometer-sized, {111}-facetted, ultrapotassic fluid/melt inclusion pockets in an Aykhal octahedral diamond sample AH2 containing healed and sealed cleavages at the core which were decorated with nanosized graphite, phlogopite and forsterite. There are abundant facetted inclusions of 10-200 nm in size which are aligned into trails ~//~ $\{111\}_{dia}$ and contain ultrapotassic fluid/melt, forsterite, or graphite. The forsterites are either rounded in pockets with excess fluid/melt, or possessing the shape molded by $\{111\}_{dia}$ in pockets with limited fluid/melt. Electron diffraction revealed that these tiny forsterites follow three major CORs by the forsterite planes, i.e. (100)-(010)-(001), in parallel/subparallel to three orthogonal planes of diamond: COR-I_{211}-{111}-{011}; COR-II_{100}-{011}-{01-1}; COR-III_{111}-{011}-{211}, and other minor CORs with $\{021\}_{fo}$, $\{120\}_{fo}$, or $\{011\}_{fo}$ parallel/subparallel to $\{111\}_{dia}$ or $\{110\}_{dia}$. Since there is hardly good two- or even one-dimensional match between forsterite and diamond for the observed CORs, along with the fact that {010}, {001}, {021}, {120} are the lowest-energy faces of forsterite and hence the expected facets of the forsterite nuclei, the observed CORs between forsterite and diamond can only be rationalized by the first precipitation of forsterite nuclei with the characteristic low energy facets in the untrapotassic fluid/melt, followed by the attachment of such nuclei to the $\{111\}_{dia}$ or $\{110\}_{dia}$ cleavages for further rotation toward a minimum energy orientation. These findings shed light not only on the *P-T-C* evolution pathway of controversial ultrapotassic fluid/melt and epitaxial olivine-diamond proto/syn/epigenesis in the mantle but also the entrapment coalescence and cleaving-healing of peridotitic diamonds under the influence of thermodynamic/kinetic factors and tectonic brittle/ductile deformation events.