Micro-Raman spectroscopy of amorphous and microcrystalline phases in the area of contact of diamond crystals with kimberlite

V.L.SKVORTSOVA[1]* AND A.V.BOBROV[1]

[1]Moskow State University. Moskow, 119991, Russia (*correspondence: valskvor@yahoo.com)

Raman spectroscopy is a powerful method for identification of carbon species not only by the presence of a characteristic frequency reflecting the covalent stretching or angle deformation in the lattice, but also by its ability to determine the crystallographic arrangement. The models of diamond origin, the composition of parental melts, and carbon speciation in host rocks are still debatable. Nondestructive study of the structure and phase composition of contact areas of diamond crystals with host rock provides evidence for the composition and evolution of diamond-forming systems.

We studied the surfaces of diamond contact with kimberlite in 34 samples (kimberlites from the Mir and Udachnaya pipes, Yakutia; Rudenko collection). Morphology and composition of of contact phases were investigated by the scanning electron microscopy (CARL ZEISS LEO 1430 VP) equipped with an energy-dispersive spectrometer. Raman spectra were obtained on a Micro-Raman HORIBA Jobin-Yvon HR800 (632,8 nm), Micro-Raman RENISHAW (532nm, 785nm), and Micro-Raman BRUKER (532nm, 785 nm) instruments.

The contact areas contained numerous amorphous and crystalline phases, such as oxides (magnetite, maghemite, hematite, wustite), carbonates (calcite, Mg-calcite and dolomite), silicates (olivine, forsterite, serpentine, diopside, enstatite), and sulfides. The presence of both carbonate and silicate peaks on some Raman spectra allowed us to distinguish silicate-carbonate phases (melts?). It is shown that application of Raman spectroscopy and SEM techniques is efficient in study of the structure of diamond-hosting layered forms (imprints) consisting of crystalline and amorphous phases. The results of Raman spectroscopy showed the presence of sp3 / sp2 hybridized carbon phases with various combinations at 1325-1600 cm-1 (micro-sized diamond, diamond-like, and carbon-bearing polycluster phases).