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TEM foils from natural diamond prepared with Focused Ion Beam (FIB):

microstructure and nanometer-sized inclusions in diamond.

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In the past TEM investigations of natural diamond was hampered by TEM foil preparation. Conventional argon ion milling of diamond preferentially removed the weaker inclusions first. Crushing the stone is a destructive method loosing information about the locality of inclusions. The electron transparent areas are limited and inhomogeneous in thickness.

Micro-inclusions in diamond provide information about the composition of the mantle (eclogitic or peridotitic), whereas nano-inclusions might yield insight in the composition of the fluid the diamond has grown. The problem of TEM sample preparation has been overcome using FIB. FIB is a site-specific technique that allows preparing foils from specific locations. TEM foils with the dimensions 15 x 10 x 0.200 μm can be cut from a stone in about 6 hours. The strongly reduced sputtering rate with diamond is significantly reduced applying the so-called selected carbon mill technique SCM?. Basic principle of SCM is the use of water vapour brought close to the milling site operating a gas injection system. Hydrous Mg-sulphate is heated in a crucible until water is released. The water molecules decompose under the Ga-ion beam thus oxidizing carbon. Oxidation of carbon and simultaneous sputtering carbon atoms with

the Ga-ions significantly enhances the milling rate.

TEM foils sputtered from diamond contain microstructural information such as dislocation density, twins, grain boundaries and nitrogen platelets. Inclusions, especially nanometer-sized inclusions in cavities, mostly less than 1 μm in diameter, are of particular interest. The presence of nanoinclusions in cavities such as silicates (phlogopite), Ba-, Sr-carbonates, phosphates, halides and Ti phases reflects an entrapment of a primary high density fluid (HDF) enriched in incompatible elements (Cl, K, P, Ba, Sr) water and carbonate (1).

References

(1) O. Klein-BenDavid, R. Wirth, O. Navon (2006) TEM imaging and analysis of microinclusions in diamond: a close look at diamond-growing fluids. Amer. Min., 91, 353-365.