STUDY OF ETCHING OF DIAMONDS IN MANTLE ROCKS - XENOLITHES FROM KIMBERLITES

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Dissolution of natural diamonds in the kimberlitic magma is one of the most disputable questions to date. Even more doubtful point in diamond genesis is the possibility of their dissolution in the mantle rocks, which are supposed to be their crystallization medium. Investigation of the inner morphology of diamond crystals frequently indicates at their complicated evolution, including the stages of dissolution.

This work is dedicated to the determination of the possibility of etching of diamonds in presence of natural silicate minerals of mantle xenolithes from kimberlites. The experiments were held on a multy-anvil high-pressure apparatus of the "split-sphere" type, according to technology, given in [1]. The flat-faced and sharp-edged natural octahedral and synthetic cubo-octahedral diamond crystals were used. For the silicate schist, the compositions from natural paragenesises, corresponding dunite, garnet lherzolite, spinel lherzolite, garnet pyroxenite, eclogite, served. The experiments with their duration of 1 hr were carried out in hermetized platinum ampoules at 5.5-6.0 GPa, 1450-1500^{0}C.

Experimental conditions and results

Experiment No	Sample	Composition	Weight, mg (%)	Dia-monds (number)	Initial wieght, mg	End weight, mg	Etch figures
4-36-97	dunite	Ol Ga	108.6 (93) 8.2 (7)	1 natural	0.57	0.57	absent
7-28-98	eclogite	Cpx Ga	67.7 (60) 45.1 (40)	1 natural	0.57	0.53	present
7-9-99	spinel lherzolite	Ol Opx Sp	95.0 (95) 3.0 (3) 2.0 (2)	1 natural	1.27	1.27	absent
7-14-99	garnet pyroxenite	Ga Cpx	73.45 (83) 15.0 (17)	2 synthetic	1.57	1.57	absent
8-25-99	garnet lherzolite	Ol Opx Ga	80.37 (82.7) 6.9 (7.1) 9.95 (10.2)	2 synthetic	1.43	1.39	present
8-30-99	eclogite	Ga Cpx	51.5 (50.7) 50.0 (49.3)	2 synthetic	1.54	1.49	present
8-37-99	spinel lherzolite	Ol Opx Sp	86.40 (81.3) 15.15 (14.3) 4.7 (4.4)	2 synthetic	1.48	1.48	present

In the experiments with dunite, garnet pyroxenite, the changes of crystals weight and morphology were not established. In case of other compositions, insignificant changes of the morphology and weight of crystals took place. In the experiments with spinel lherzolite, the changes related only to the micromorphology of crystal faces, while the weight loss was not determined. In case of garnet lherzolite, diamonds had lost 0.04 mg (2.8 %) of their weight. The most significant weight loss was fixed for diamond crystals in the experiments with eclogite: 7 and 3.2 %, the first value corresponding the experiment with the higher content of pyroxene relative to garnet. The etch figures, which occurred in the experiments, are similar to those known for natural crystals and previously reproduced during diamond etching in silicate melts at the P-T parameters, corresponding the field of thermodynamic stability of graphite [1]. At the {111} faces, the triangular etch pits, oriented reverse relative to the face outline (negative trigons), are most common. The flat-bottomed, as well as pyramid-shaped etch pits, 0.01-0.08 mm in size, were formed. Near the edges between octahedral faces, the etch layers in the form of parallel striation occurred. Near the edges between octahedral and cubic faces, the etch layers had "dentate" outline ("stairs-like pattern"). The incident angle between the "dents" was 60^0. The lateral parts of the layers, as well as those of the etch pits, were constituted by the surfaces, corresponding trigon-trioctahedron. The {100} faces were etched with the exceptional formation of etch pits of rectangular outlines, parallel to the edges between octahedral and cubic faces. Besides, in the experiment No 8-37-99, the unusual etch figures ap-

peared - flat, of various size, mainly rectangular, representing positive forms of the topography, lacking crystallographic orientation. Perhaps, they represent the prints of silicate phases during the etching.

As the melting of silicate melts was not reached in the experiments, the conclusion can be made, that it was the natural content of volatiles in silicate minerals, that accounted for diamond etching. The investigation, that was carried out, points at the principal possibility of diamonds' etching at the parameters of their thermodynamic stability, as well as at the composition of fluid, encapsulated in mantle minerals, being close to that, equiponderous to diamond.

1. Chepurov A.I., Fedorov I.I., Sonin V.M. Experimental modeling of diamond formation processes. Novosibirsk: NIC UIGGM SB RAS Publishing house, 1997. 196 p.