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Influence of metal ions on diamond resorption

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Numerous studies provided solid evidence that resorption processes are very important for morphology of natural diamonds. Majority of experimental studies of the resorption processes and features concentrate on effect of water/CO_2 fluids, influencing interpretation of observations on natural crystals. Earlier [1] it was shown that ratio of ionic radius and configuration/length of chemical bonds on particular diamond crystallographic face determines rate and details of the resorption processes. In this work we aim at elucidation of role of individual metal ions in shaping diamonds during the etching and employ concepts derived from chemistry of catalytic reactions.

Field-Emission SEM and Atomic Force Microscopy are used for detailed morphological investigation of diamonds resorbed in presence of various ions and media. It is shown that in experiments at 1 GPa – 900 ^{o}C admixture of Fe, Cr, Ni, Co ions with radii close to {110} interatomic distance, the diamond oxidation rate in H_2O increases 10-15-fold and in CO_2 even up to 40 times. In presence of Fe and Cr ions in water vapour rounded steps are revealed on {110} faces; Ni ions reveal shagreen texture. CO_2 fluids with Cr, Ni, Co ions leave extremely rough surfaces, but when Fe ions are present weak striation at {110} and flat-bottomed trigonal pits at {111} are observed.

The large effect of chemistry of metal ionic species of process of diamond resorption is clearly observed in our experiments. Presumably, similar effects also operate in natural environments and should be taken into account in interpretation of mineralogical obserations.

[1] Rudenko *et al*., (1979) *New Data on Minerals*, **28**, 105-125.