

Fe and Ni impurities in synthetic diamond

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ABSTRACT

Using synchrotron X-ray fluorescence (XRF) microanalysis, including XRF tomography, and X-ray absorption near-edge structure (XANES) analyses, the distribution, and nature of incorporation of Fe and Ni impurities in as-grown diamond crystals, synthesized under high-pressure and high-temperature (HPHT) conditions, have been characterized. We find significantly different behavior for Fe and Ni as impurities in diamond. Nickel is dispersed and sector-zoned, with concentrations in {111} growth sectors at least 3 times those in {100} sectors, whereas Fe exists in the form of micro-aggregates or clusters with no observable sector correlation. Fe *K*-edge XANES shows that Fe is oxidized in diamond and has a valence of 2+. Comparison of XANES spectra from numerous standard compounds indicates that Fe is very likely bonded with oxygen as FeO.