Optical Centers Related to 3d Transition Metals in Diamond

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In the last three decades, extensive experimental studies have revealed numerable optical systems related to 3d transition metal (TM) ions in synthetic high-pressure, high-temperature (HPHT) and natural diamonds. Most of them were associated with nickel and cobalt and only a few are due to other TMs. A lot of structure-sensitive physical techniques including electron paramagnetic resonance (EPR) have been used to determine the structure of the centers in as-grown HPHT diamonds and the main trends in impurity transformation upon annealing have been established. The defects ranged from the simplest such as TM in substitutional, interstitial and double semivacancy sites to complicated TM-nitrogen complexes. Unfortunately, only for very few TM centers the optics-to-EPR correlations have been proved reliably; on the other hand, many of the TM defects are nonparamagnetic. Spectroscopic data concerning TM centers in diamond is summarized, defect structure is discussed and some applications are considered.

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