# Magnetic Resonance Study of Nanodiamonds

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Magnetic Resonance techniques, namely Electron Paramagnetic Resonance (EPR) and solid state Nuclear Magnetic Resonance (NMR), are powerful non-destructive tools for studying electron-nuclear and crystalline structure, inherent electronic and magnetic properties and transformations in carbon-based nanomaterials (fullerenes, nanotubes, nanographites etc.). EPR allows controlling purity of ultradispersed diamond (UDD) samples, study of origin, location and spin-lattice relaxation of radical-type carbon-inherited paramagnetic centers (RPC) as well as transformation of these RPC during their evolution in the process of temperature driven diamond-to-graphite conversion. Solid state NMR on $^{1}H$ and $^{13}C$ nuclei may give an idea on the crystalline quality, allows quantitative estimation of the amount of different allotropic forms, and reveals electron-nuclear interactions within the UDD samples under study. Results of recent EPR and $^{13}C$ NMR study of pure and transition metal doped UDD samples, obtained by detonation technique, are reported and discussed. In addition to characteristic EPR signals, originated form para- and ferro-magnetic impurities and doping ions, the UDD samples show a high concentration of RPC (up to $10^{20}$ spin/gram), which are due to structural defects (dangling C-C bonds) on the diamond cluster surface. The anomalous reduction in the spin-lattice relaxation time of $^{13}C$ (from several hours in natural diamond to ~ 150 ms in UDD clusters) is attributed to the interaction between the unpaired electrons of RPC and nuclear spins. $^{13}C$ NMR line-width reflects the fact that the structure of the UDD surface is distorted in comparison to the 'bulk' diamond structure.