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Impurities and electron spin relaxations in nanodiamonds studied by multi-frequency electron spin resonance FRANKLIN CHO, Department of Physics, University of Southern California, SUSUMU TAKAHASHI, Department of Chemistry and Physics, University of Southern California — Nano-sized diamond or nanodiamond is a fascinating material for potential applications of fluorescence imaging and magnetic sensing of biological systems via nitrogen-vacancy defect centers in diamonds. Sensitivity of the magnetic sensing strongly depends on coupling to surrounding environmental noises, thus understanding of the environment is critical to realize the application. In the present study, we employ multi-frequency (X-band, 115 GHz and 230 GHz) continuous-wave (cw) and pulsed electron spin resonance (ESR) spectroscopy to investigate impurity contents and spin relaxation properties in various sizes of nanodiamonds. Spectra taken with our home-built 230/115 GHz cw/pulsed ESR spectrometer shows presence of two major impurity contents; single substitutional nitrogen impurities (P1) also common in bulk diamonds and paramagnetic impurities (denoted as X) unique to nanodiamonds. The ESR measurement also shows a strong dependence of the population ratio between P1 and X on particle size. Furthermore, we will discuss the nature of spin-lattice relaxation time T_1 of nanodiamonds studied by pulsed ESR measurements at X-band, 115 GHz and 230 GHz.

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