Defects localization and nature in bulk and disperse ultrananocrystalline diamond

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Abstract

We report about the electron paramagnetic resonance and nuclear magnetic resonance signals in bulk and thin film-type Ultrananocrystalline diamond with and without nitrogen.

The localization and nature of defects for powder and compact film samples were analyzed. From the analysis of spin-lattice and spin-spin relaxation times, we have found that spin states sit in sp^2 enriched region belonging to the grain boundaries.

1. Introduction

Controlling and understanding the conductivity via doping of shallow donors or acceptors is essential for the fabrication of semiconductor devices. Due to a set of singular structural and electronic characteristics Ultrananocrystalline diamond (UNCD) is a promising platform material for a large number of electronic applications [1, 2]. Ultrananocrystalline diamond (UNCD) is a unique form of carbon consisting of randomly oriented 3-5 nm crystallites surrounded by atomically abrupt 0.2nm wide, largely sp^2 bonded grain boundaries. Many of its properties are closely connected to their unique nanoscale morphology and electronic structure. In particular, the electronic transport has been shown to be sensitive to this nanostructure, as ≈ 10% of carbon is at