

Dynamic nuclear polarization of Zn 67 and H1 spins by means of shallow donors in ZnO nanoparticles

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Abstract

Dynamic nuclear polarization (DNP) effects are observed of Zn 67 ($I=5/2$) nuclear spins in ZnO nanoparticles and of H1 ($I=1/2$) spins of the Zn (OH) 2 capping layer. The almost complete polarization of these nuclear spins is achieved by saturating the electron paramagnetic resonance transition of the shallow interstitial Li donor present in the ZnO nanoparticles. The remarkable aspect is that this DNP is caused by an Overhauser mechanism although the phonons mediating the polarization process do not fit into the nanoparticles. An explanation of this DNP process is presented, and it is shown that this allows for a measurement of the distribution of phonon modes in the nanoparticles. The enhancement of the nuclear polarization also opens the possibility to study semiconductor nanostructures with NMR techniques. © 2009 The American Physical Society.

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