Dynamic nuclear polarization in silicon

CHANDRASEKHAR RAMANATHAN, Massachusetts Institute of Technology, MAJA CASSIDY, Harvard University, ANATOLY DEMENTYEV, Massachusetts Institute of Technology, CHARLES MARCUS, Harvard University, DAVID CORY, Massachusetts Institute of Technology — We report on our DNP experiments on silicon wafers and nanoparticles. The DNP mechanism in n-doped wafers depends on the doping concentration, and a broad range of DNP enhancements have been observed. The largest enhancements we have recorded (over 200) were for wafers with donor concentrations in the range of $1 - 3 \times 10^{17} \text{ cm}^{-3}$, where the DNP is mediated by exchange-coupled clusters of donors. The silicon polarization obtained was over 10%. We have also characterized the DNP of silicon nanoparticles suspended in a frozen solution. Off-resonant microwave irradiation of paramagnetic electron defects at the silicon-silicon dioxide interface in the nanoparticles results in a hyperpolarization of both the silicon spins of the particle as well as the water protons at the surface of the particle.

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Date submitted: 20 Nov 2009

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