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Temperature and size dependence of electron magnetic resonance spectra of Ni nanoparticles chemically dispersed in silica VIVEK SINGH, MOHINDAR SEEHRA, West Virginia University — The temperature dependence (5K to 300K) of the electron magnetic resonance (EMR) lines observed at 9.28 GHz in Ni:SiO_2 (15:85) nanocomposites with mean diameter D of the Ni nanoparticles (NPs) of D=3.8, 11.7, 15 and 21 nm are reported. The sizes of the Ni NPs were determined by TEM and XRD, with SiO_2 being in the amorphous state. The procedures for the synthesis of the samples along with their DC and AC magnetization behavior were reported recently [1]. In EMR, three resonance lines are observed: (i) Line 1 with linewidth $\Delta H \simeq 50$ Oe and $g \simeq 2$, and Curie-like variation of the line-intensity, with ΔH and g being temperature and size-independent; (ii) Line 2 with $\Delta H \simeq 950$ Oe and $g \simeq 2.2$ for D=3.8nm at 300K with both ΔH and g increasing with decreasing T and ΔH size-dependent; and (iii) weak line 3 with $g \sim 4$ at 300K, with g also increasing with decreasing T. We argue that the line 1 is due to dangling bonds in SiO_2 as a similar line with $\Delta H \simeq 9$ Oe is also observed in SiO_2 without Ni doping. Lines 2 and 3 are attributed to majority Ni NPs and large Ni clusters respectively whose anisotropy is both size and temperature-dependent [2], leading to the observed ΔH and g values of the lines.

[1]. Singh, Seehra and Bonevich, J. Appl. Phys. 103, 070524 (2008) and ibid (in press).
[2]. R. S. de Biasi and T. C. Devezas, J. Appl. Phys. 49, 2466 (1978).

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