Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

On the Cubic Phase Stability and Magnetic Properties of Cu-doped ZrO$_2$ S. THOTA, Physics Dept., IIT Guwahati, India, K. PISANE, S. SINGH, M.S. SEEHRA, Physics Dept., West Virginia University — Magnetic properties and room temperature cubic-phase stability of Cu-doped ZrO$_2$ nanocrystallites (16 nm size) with various compositions of Zr$_{1-x}$Cu$_x$O$_{2-x}$ (0.01 ≤ x ≤ 0.25) are reported. The samples were synthesized at a constant pH = 8 using zirconyl nitrate hydrate and copper acetate monohydrate as precursors and ethanol as a solvent. Thermal analysis shows that the cubic phase is not stable beyond calcination temperature of 500°C for 8 hours in air and a critical composition x$_c$ ≈ 0.10. For x > x$_c$, monoclinic ZrO$_2$ and CuO emerge as secondary phases with a shrinking unit-cell volume for increasing Cu content. Against expectations [1], the temperature and magnetic field dependence of magnetization exhibit no signatures of ferromagnetism down to 2 K. Instead, temperature dependence of magnetic susceptibility for all compositions yields Curie-law variation with a magnetic moment $\mu \approx 1.3\mu_B$ per Cu$^{2+}$, which is somewhat smaller than the expected value of $\mu \approx 1.9\mu_B$ per Cu$^{2+}$. Electron magnetic resonance studies show a signal near $g \approx 2.1$ due to Cu$^{2+}$ substituting at Zr$^{4+}$ sites with four-line hyperfine splitting from the nuclear spin I = 3/2 of Cu.


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Date submitted: 13 Nov 2013

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