Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Size Fractionation of Mechanochemical Synthesized Alkyl-Passivated Silicon Nanoparticles LUIGI VERDONI, BRIAN MITCHELL — A novel top-down procedure was employed for the synthesis of stable alkyl-passivated silicon nanoparticles using reactive high energy ball milling (HEBM) as described in Heintz et al., (Adv. Mater. 2007, 19). The method provides for the simultaneous production of photo luminescent silicon nanoparticles and the passivation of the particle surface with alkyl groups covalently linked through Si-C bonds. As fresh silicon surface is formed during HEBM by particle fracture, the surface Si atoms react in-situ with liquid alkyls, such as 1-octyne and 1-hexyne. We present a multistage size selective fractionation process to isolate and purify initial sample polydispersities ranging from microns down to single nanometers (1 um - 1 nm). This process employs centrifugation, inline nano-filtration, both normal phase gel permission (GPC) and size exclusion chromatography (SEC), followed by recursive size selective precipitation (SSP). Size evolutions of fractions are monitored via UV/VIS absorbance, photoluminescence (PL), and electron microscopy (SEM/TEM). Elemental impurities are quantified through atomic absorption (AAS) and energy dispersive spectroscopy (EDS). Stages are performed in series to isolate and investigate the influence of initial alkyl and silicon reactants on product yields, size dispersity, and optical behavior.

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Date submitted: 08 Oct 2009 Electronic form version 1.4