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Size dependent band gap energy in stannite nanocrystals

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Resume : The stannite has attracted considerable attention for absorber layers in thin film solar cells. In this research, we are attention to the changes of band gap energy for the stannite nanocrystals. The stannite nanocrystals were synthesized by high-temperature arrested precipitation in the coordinating solvent, oleylamine (OLA). To investigate the effect of crystal size, the solution heated to different reaction temperatures of 230 °C, 280 °C, and 330 °C. These were designated as A, B, and C, respectively. From analysis of HR-TEM data, as increasing the reaction temperature the crystal shapes are changes from sphere to polygon shape and crystal sizes are increased from 10 nm to 200 nm. The absorption spectra of the stannite nanocrystals are measured using UV-vis absorbance spectroscopy. The band gap of the stannite nanocrystals is estimated to be 1.3 eV, 1.6 eV, and 1.7 eV for C, B, and A respectively, by extrapolating the linear region of a plot of the absorbance squared versus energy. In order to study the change of the detailed local structure on samples, Mössbauer spectroscopy has to be applied. There are exist poorly resolved quadrupole doublet with electric quadrupole shift values are 2.73, 2.80, 2.83 mm/s for A, B, and C respectively, correspond to Fe^{+3} atoms and well resolved quadrupole doublet with electric quadrupole shift values are 0.59, 0.53, 0.50 mm/s for A, B, and C respectively, correspond to Fe^{+2} atoms for all samples.

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