Abstract Submitted
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Synthesis of Core-shell Structured Amorphous Si Nanoparticles by Induction Thermal Plasmas DAISUKE OKAMOTO, TAKUYA KAGEYAMA, Department of Chemical Systems and Engineering, Kyushu Univeristy, MANABU TANAKA, Department of Chemical Enginerring, Kyushu University, HIROTAKA SONE, Department of Chemical Systems and Engineering, Kyushu Univeristy, TAKAYUKI WATANABE, Department of Chemical Enginerring, Kyushu University — Core-shell structured amorphous Si nanoparticles were synthesized by induction thermal plasma. Crystalline Si powder with 3 μm of average diameter was injected into the induction thermal plasma at 4MHz. The Si raw materials immediately evaporate in the high temperature plasma region and nanoparticles were produced through the quenching process. Counterflow quenching gas was injected from downstream of the torch with its direction against the plasma flow. The effect of the operating parameter such as flow rate of quenching gas and input power was investigated. Collected particles were characterized by X-ray diffraction, transmission electron microscopy, electron energy-loss spectroscopy, and Raman spectroscopy. Obtained results indicate that amorphization degree of the synthesized nanoparticles is more than 90% when additional quenching gas of 20 L/min is injected. The quenching rate of the prepared nanoparticles in the growth region have an important role on determining the amorphization degree. Moreover, EELS and Raman analyses showed the synthesized nanoparticles were coated by the SiO_2 shell with thickness of 2-4 nm. These findings indicated that amorphous Si/SiO_2 core-shell structured nanoparticles were successfully synthesized by induction thermal plasma in single step.

Takayuki Watanabe
Department of Chemical Enginerring, Kyushu University

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