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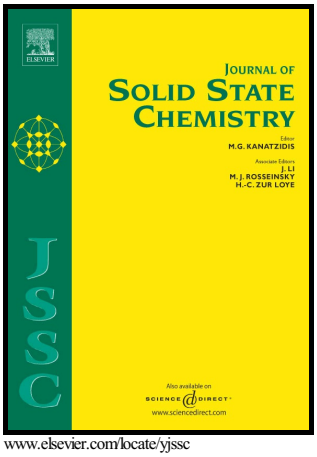

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A study on crystallization of amorphous nano silica particles by mechanical activation at the presence of pure aluminum

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Abstract:

Thermal and mechanical activation methods for crystallization of amorphous nano silica particles were investigated. Thermal crystallization of amorphous $SiO_{2(np)}$ was studied by differential scanning calorimetry as well as heating the amorphous particles under argon atmosphere. The results showed that crystallization of amorphous $SiO_{2(np)}$ started at temperatures above 700 °C and the synthesized crystalline silica had an average size of about 200 nm. Furthermore, 50wt.%Al-50wt.% amorphous $SiO_{2(np)}$ mixtures were mechanically activated at ambient conditions. The results showed that crystallization of amorphous $SiO_{2(np)}$ started after about 7.5 hours of ball milling and reached its peak at 60 hours. Longer milling times resulted in re-amorphization of part of the crystallized silica. The average size of crystalline $SiO_{2(np)}$ synthesized by mechanical activation was about 30 nm. A diffusion induced mechanism for crystallization of the amorphous nano silica, based on diffusion of aluminum atoms assisted by mechanical activation, was also proposed and discussed.

Graphical abstract

Mechanical crystallization of amorphous nano silica particles through ball milling of Aluminum-amorphous silica powder at room temperature resulted in crystalline silica with an average size of about 30 nm. A diffusion induced mechanism based on mechanical activation assisted diffusion of aluminum atoms in to amorphous silica was proposed for mechanical crystallization of amorphous silica.