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EPR of Ni^{2+} ions in macro porous nanocrystalline $CaSiO_3$ ceramic powders

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Abstract

Porous wollastonite ($CaSiO_3$) and Ni^{2+} doped (1, 2, 2.5 3 and 5 mol%) wollastonite ceramic powders have been synthesized by a novel self-propagating, gas producing solution combustion process. The solution combustion method renders a low-temperature synthetic route to prepare fine-grained wollastonite powders with better sintering properties. Single phases of β-$CaSiO_3$ and α-$CaSiO_3$ were observed at 950 °C and 1200 °C respectively. The samples calcined at 950 °C has low porosity, however the porosity increases with increase in calcinations temperature. The agglomeration of the solution combustion product was determined by SEM and the average agglomerated particle size of calcined $CaSiO_3$ is in the range 1 to 10 μm. The EPR spectrum of Ni^{2+} ions in $CaSiO_3$ exhibits a symmetric absorption at g = 2.23 ± 0.01. Owing to the moderately high spin orbit coupling, the isotropic g factor of octahedrally coordinated Ni^{2+} departs from the free electron g value, g_e. The number of spins participating in resonance (N) and the paramagnetic susceptibilities (χ) have been evaluated from EPR data as a function of Ni^{2+} content. The effect of alkali ions (Li, Na and K) on the EPR spectra, have also been studied and the spectra exhibit a marked alkali effect. The results obtained from these studies have been discussed in detail.

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