

Small angle neutron scattering study of a gehlenite-based ceramic fabricated from industrial waste

ABSTRACT

This paper presents a small angle neutron scattering (SANS) study of a novel porous gehlenite-based ceramic, synthesised from a homogeneous powder mixture of soda-lime-silicate (SLS) glass, α -alumina, calcite and calcium fluoride via solid-state sintering at 1200 °C. The products of sintering at single temperatures from 600 to 1200 °C are examined by X-ray diffraction (XRD). Sintering of the mixture below 1200 °C forms two intermediate phases ($\text{Na}_2\text{CaSi}_3\text{O}_8$ and $\text{Ca}_4\text{Si}_2\text{O}_7\text{F}_2$). Nepheline and α -alumina are minor phases in the gehlenite-based ceramic fabricated through sintering at 1200 °C. The microstructure of the gehlenite-based ceramic is investigated using field-emission scanning electron microscopy (FESEM) and SANS at the Australian Centre for Neutron Scattering. This study also evaluated the specific surface area of the gehlenite-based ceramic ($\sim 3.0 \text{ m}^2 \text{ cm}^{-3}$) from quantitative analysis of SANS data.

Keyword: Neutron scattering; Gehlenite; Ceramic; Waste; Solid-state sintering