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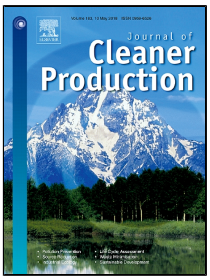

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Functional Glass-ceramic Foams from 'Inorganic Gel Casting' and Sintering of Glass/Slag Mixtures

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Abstract

The here described investigation was essentially aimed at exploring the chemical stabilization and reutilization of iron-rich slag from copper metallurgy, by the manufacturing of glass-ceramic foams. The foams were developed according to a new method, recently reported for pure recycled soda-lime glass. Mixtures of soda-lime glass/slag powders (with slag content ranging from 10 to 30 wt%), suspended in alkaline aqueous solution, underwent progressive low temperature (80 °C) hardening, owing to the formation of hydrated calcium silicate compounds (C-S-H). Before complete setting, an extensive foaming could be achieved by vigorous mechanical stirring, with the help of a surfactant.

After foaming, glass/slag mixtures could be sintered at 800-1000 °C; the mutual interaction caused an extensive crystallization, with precipitation of Ca-Fe silicates and iron oxides (hematite and magnetite), promoting the mechanical properties (up to 4.4 MPa, with a porosity of about 80%). Leaching test confirmed the stabilization of pollutants, from the slag, in the final ceramics. Owing to the separation of iron oxides, particularly magnetite, the newly obtained foams exhibited a ferrimagnetic behavior, that could be exploited in electromagnetic shielding applications.

Keywords: Gel casting; Alkali activation; Glass ceramic foams; Copper slag; Electromagnetic shielding.

Highlights

- Suspensions of soda-lime glass and copper slag may harden by low alkali activation
- Porous green bodies achievable by vigorous stirring in the initial steps of gelation
- Hardened foams transformed into glass-ceramic foams by firing at 800-1000 °C
- Ferri-magnetic phases developed upon firing providing electromagnetic shielding