**NOVEL ‘INORGANIC GEL CASTING’ PROCESS FOR THE MANUFACTURING OF GLASS-CERAMIC FOAMS**

Acacio Rincón1, Enrico Bernardo1
Department of Industrial Engineering, University of Padova, Italy

**INTRODUCTION**
- Conventional glass foams are manufacturing by gas evolution, in a pyroplastic mass of softened glass, provided by substances undergoing thermal decomposition or oxidation.
- A new technique for the production of glass foams was developed, based on alkali activation and gel casting. This technique also allows the incorporation of metallurgical slag.
- A 'weak alkali activation' of the glass/slag mixtures is not intended for complete dissolution of components, but it is aimed at developing gels in turn allowing for low temperature hardening.
- A sintering treatment, at 800-1000 °C, may be later applied to convert highly porous 'glass-based mortars' into glass-ceramic foams sowing to glass-slag interactions, limiting the leaching of alkaline ions.

**METHODS AND MATERIALS**

**RESULTS AND DISCUSSION**

**Microstructural details of the hardened foams**
- After gel hardening high uniformity of pores.
- Pore structure influenced by the amount of copper slag added.
- At 800 °C some reshaping of the pores during the heat treatment.
- At 900 °C some cell coalescence, but an overall homogeneous cellular structure is maintained.
- A significant coalescence is observed for foams obtained at 1000 °C.

**FTIR spectra of selected materials**
- High –OH absorption for the green foams, thanks to the formation of hydrated compounds after the alkali activation.
- Bands from 1290 to 900 cm\(^{-1}\) and at 800 and 450 cm\(^{-1}\), are identified with Si-O-Si groups.

**X-ray diffraction patterns**
- Fayalite (Fe\(_2\)SiO\(_4\)), as main crystal phase in the copper slag, it is not dissolved upon alkaline activation.
- Shifting of the ‘amorphous halo’ after the alkaline activation.
- After heat treatment main crystal phases wollastonite (CaSiO\(_3\)) and hedenbergite (CaFe\(_2\)Si\(_2\)O\(_6\)).
- Reduction of iron oxides formation of magnetite (Fe\(_3\)O\(_4\)) and hematite (FeO).

**Mechanical properties of the developed glass-ceramic foams**

<table>
<thead>
<tr>
<th>Firing T (°C)</th>
<th>% total P</th>
<th>% open P</th>
<th>p (g/cm(^3))</th>
<th>(\sigma) (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>800</td>
<td>76 ± 3</td>
<td>59 ± 9</td>
<td>0.23 ± 0.03</td>
<td>4.3 ± 0.9</td>
</tr>
<tr>
<td>900</td>
<td>78 ± 3</td>
<td>70 ± 4</td>
<td>0.22 ± 0.03</td>
<td>2.3 ± 0.4</td>
</tr>
<tr>
<td>1000</td>
<td>75 ± 7</td>
<td>45 ± 9</td>
<td>0.24 ± 0.07</td>
<td>3.3 ± 1.1</td>
</tr>
</tbody>
</table>

**Magnetic shielding**

**REFERENCES**

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