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Development of glass formulations for sealing applications in high-temperature steam electrolysis

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Hydrogen production by high-temperature steam electrolysis is achieved using complex structures such as Solid Oxide Cells (SOC) stacks. Ensuring the sealing of this metallic/ceramic multilayer is technically very challenging. The sealing solution needs to meet several properties. Specific thermomechanical, chemical and electrical properties are mandatory for the sealing material in SOC stacks. Glasses and glass-ceramics have been identified as suitable candidates.

This study consists in the development of glass sealants for high-temperature electrolysis applications. Four glass systems have been identified as potential sealants for SOC currently developed at CEA. Based on literature review, glasses compositions were chosen due to their matching properties with the required ones. Figure 1 displays composition areas in CaO-Al₂O₃-B₂O₃ and BaO-Al₂O₃-B₂O₃ glass systems in which the Thermal Expansion Coefficient (TEC) corresponds to the required values.

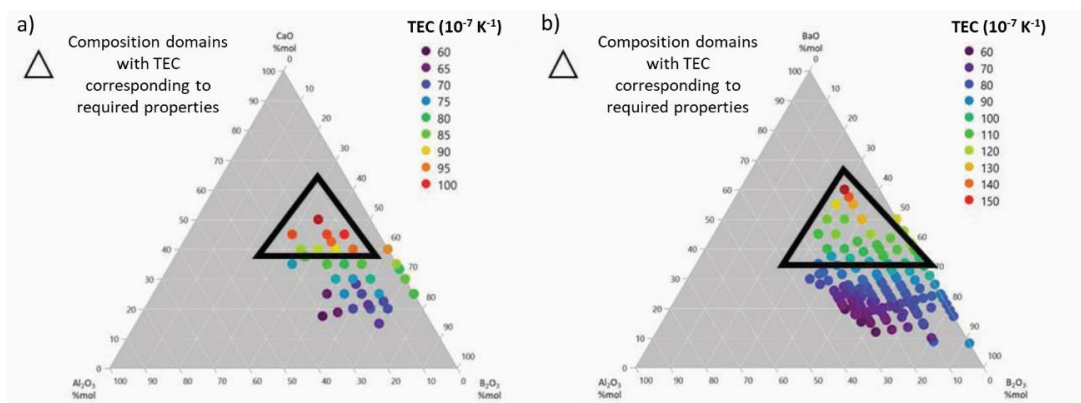


Figure 1 : Composition areas in a) CaO-Al₂O₃-B₂O₃ and b) BaO-Al₂O₃-B₂O₃ glass systems in which TEC corresponds to the required values [1-4]

Modifications of glasses compositions were studied in order to tailor sealants thermomechanical properties (glass transition temperature, softening temperature and TEC) and to reduce the probability for deleterious devitrification in SOC working conditions. Several samples have been elaborated and their properties characterized as raw and thermally treated glasses.

Glass samples were thermally treated at different temperatures and for different durations. They were then characterized by SEM-EDS and X-Rays Diffraction to get insights into the crystallized phases. TEC of resulting glass-ceramic samples were also measured in order to assess thermal treatments influence.

This poster presents results obtained on a specific glass system.

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