Structure and Performances of Boroaluminosilicate Sealing Glasses for Solid Oxide Fuel Cells

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Structure and Performances of Boroaluminosilicate Sealing Glasses for Solid Oxide Fuel Cells

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Abstract

The solid oxide fuel cell (SOFC) is one of the most important new energy technologies in the 21st century, owing to its high rate of energy conversion, low pollution, and good compatibility with various fuels (such as hydrogen, methanol, methane, alcohol, etc.).[1] However, during the operation of SOFCs (600-800°C), service life and safety are the main bottlenecks restricting their development. To solve these problems, stabilities of all components of the SOFC should be considered, including the cathode, anode, electrolyte, interconnect and sealing material. Among them, the sealing material is crucial for safe and stable operation of the SOFC because once the sealing fails, the gas from the cathode and anode will mix and explode at high temperatures.[2] Sealing glass, as one of the most promising candidates of sealing materials, still faces challenges such as poor long-term stability and thermal cycle stability. These challenges are related to the thermal and chemical stability, as well as mechanical properties of the glass. In this study, we report the structural evolution and changes in performances (thermal stability, chemical stability, mechanical properties, i.e., hardness and elastic modulus, and sealing performance, etc.) of boroaluminosilicate sealing glasses as the heat-treatment time extends. We also determine the residual stress at the interface between the sealing glass and the interconnect (stainless steel) after isothermal treatment at 700°C for 48 h using X-ray diffraction method.[3] These results can provide important information for the designing and developing of sealing glass for SOFCs.

Key words: Sealing Glass; Structural Evolution; Mechanical Properties; Thermal Properties; Sealing Performance

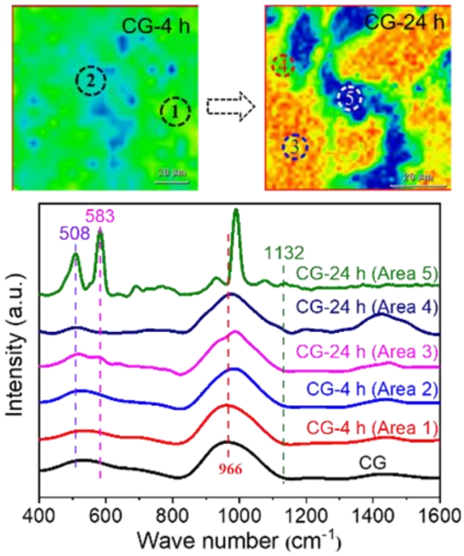

Fig. 1 Raman maps and spectra of the sealing glass before and after heat-treatment at 700°C for various durations.

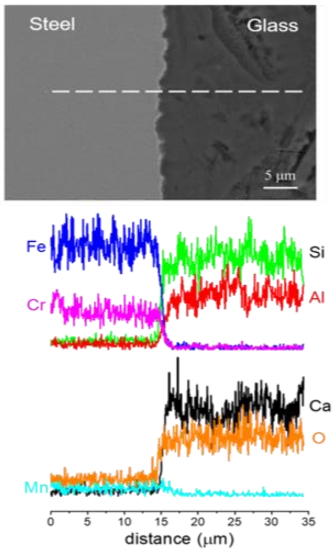

Fig. 2 SEM micrographs and EDS lines of the sealing interface between the steel and glass after heat-treatment at 700°C for 48 h.

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