Effect of MgO addition on the crystalline phase formation and thermal expansion of a barium aluminosilicate solid oxide fuel cell glass-ceramic sealant.

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Two of the primary challenges in developing glass sealants for solid oxide fuel cell stacks are stabilizing the thermal expansion of the sealant as a function of time at a specific temperature and minimizing its reactivity with metal components. The effect of the addition of nano-MgO to BCAS glass was investigated with emphasis on phase development and change in thermal expansion with de-vitrification. Glass-MgO compositions corresponding to 0%, 5%, 10% and 15% MgO additions by volume were prepared. The compositions were de-vitrified at 800^{o}C for 30 minutes and 48 hours and phase analysis was carried out by XRD. The thermal expansion of the above compositions was measured on bar samples after de-vitrification at 800^{o}C for 30 minutes and 900 hours, using a dilatometer. The phase-mix changed with varying amounts of MgO addition and heat treatment conditions. The (coefficient of thermal expansion) CTE of the glass-MgO compositions varied, depending on the CTE of the crystalline phases present. The CTE of BCAS glass with 15 vol.% MgO was 12.4 x 10^{-6}/ ^{0}C after de-vitrification at 800^{o}C for 30 minutes and reduced by only 2.4% when maintained at this temperature for 900 hours.

Modified glass compositions were formulated based on the above information and ensuring adequate flow properties at the sealing temperature. A perovskite based coating was developed for application on the sealing area of commonly used metallic interconnects. Sandwich structures consisting of yttria stabilized zirconia – glass-MgO sealing composition – coated interconnect were heat treated at 800^{o}C for different durations and the interfaces were examined microscopically to assess the quality of sealing.