

Some Novel Studies on Sealing Glass/glass-ceramics Materials.

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Hermetic seals are required in energy conversion devices such as solid oxide fuel cells, as feedthroughs for packaging of power devices and chemical plants, coatings for surface passivation etc. Various workers have studied the nature of bond between glass and metal for a long time and different theories have also gradually emerged. Different glass compositions based on silicate, borates, phosphates have been reported for synthesizing the glass-ceramics suitable for seals to be used under normal and high temperature conditions in vacuum for low and high electric fields as well as in normal and corrosive ambient conditions. In this talk we shall present basic requirements of sealing glasses/glass-ceramics for both ambient and high temperature applications. Alkaline earth based silicate glasses and glass-ceramics have been reported as potential materials for high temperature applications. BaO based silicate glasses are most widely studied for this purpose but one of the main problems arises due to the formation of BaCrO₄ phase during prolonged high temperature use thereby deteriorating the performance. In view of this we have studied some other compositions like barium/strontium zinc silicate (B/SZS), BaO-CaO-Al₂O₃-B₂O₃-SiO₂ (BCABS), barium strontium aluminosilicate (BSAS) and strontium aluminosilicate with different additives. The effect of P₂O₅ incorporation on the sintering and flow characteristics of BCABS glasses was investigated in detail and found 1 mol% P₂O₅ a good compromise for sealing with improved adhesion. To avoid the negative effect of P₂O₅ on sealing glass properties, we combined it with Barium oxide (Ba₃(PO₄)₂) in a new glass formulation. These systems have been characterized for phase formation, structural and micro-structural modifications, thermal expansion and long term stability. Novel synergetic effect of V₂O₃ and P₂O₅ on the sealing properties of barium strontium aluminosilicate glass/glass-ceramics will also be brought out.

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