
Effect of residual stress on the ionic conductivity of yttria stabilized zirconia nano-films

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Abstract

The effect of residual stress on the ionic conductivity of yttria stabilized zirconia (YSZ) polycrystalline nano-films deposited onto quartz substrate via pulsed-DC magnetron sputtering was systematically studied. The residual stress of YSZ film was evaluated by a $\cos^2\sin^2$ method. The X-ray diffraction data indicated that a sputtering-induced compressive residual stress developed in the as-deposited film, increased with film thickness, and deteriorated ionic conductivity. On the other hand, a thermal-mismatch-induced tensile residual stress developed in the annealed film, increased with annealing temperature, decreased with film thickness, and enhanced ionic conductivity. Ionic conductivities higher than the YSZ bulk were measured in both the as-deposited and annealed YSZ nano-films, indicating the existence of interface enhancement effect on ionic conductivity.

Keywords: residual stress, ionic conductivity, yttria stabilized zirconia (YSZ) films.

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