

## Effects of Copper Oxide Doping on Hydrothermal Ageing in Alumina Toughened Zirconia

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**Abstract :** This study investigates the hydrothermal aging behavior of undoped and copper oxide-doped alumina-toughened zirconia (ATZ). The ATZ ceramic composites underwent conventional sintering at temperatures ranging from 1250 to 1500°C with a holding time of 12 minutes. XRD analysis revealed a stable 100% tetragonal phase for conventionally sintered ATZ samples up to 1450°C, even after 100 hours of exposure. At 1500°C, XRD patterns of both undoped and doped ATZ samples showed no phase transformation after up to 3 hours of exposure to superheated steam. Extended exposure, however, resulted in phase transformation beyond 10 hours. CuO-doped ATZ samples initially exhibited lower monoclinic content, gradually increasing with aging. Undoped ATZ demonstrated better-aging resistance, maintaining ~40% monoclinic content after 100 hours. FESEM images post-aging revealed surface roughness changes due to the tetragonal-to-monoclinic phase transformation, with limited nucleation in the largest tetragonal grains. Fracture analysis exhibited macrocracks and microcracks on the transformed surface layer after aging. This study found that 0.2wt% CuO doping did not prevent the low-temperature degradation (LTD) phenomenon at elevated temperatures. Transformation zone depth (TZD) calculations supported the trend observed in the transformed monoclinic phase.

**Keywords :** alumina toughened zirconia, conventional sintering, copper oxide, hydrothermal ageing

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