

## **Effect of Sintering on Yttria Distribution and Low Temperature Degradation of 3Y-TZP Ceramics**

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### **Abstract**

In this study, we investigated the effect of sintering atmosphere and temperature on surface yttria concentration of 3 mole % yttria stabilized tetragonal zirconia polycrystalline (3Y-TZP) ceramic. The 3Y-TZP ceramic powder was die pressed into discs (20mm diameter and 5 mm thickness) followed by cold isostatic pressing at 200 MPa. Then the green compacts were sintered by using tube furnace at air and argon gas atmosphere at sintering temperatures of 1400 °C and 1500 °C for 2 hours. Yttria concentration was measured by X-ray florescent analytical microscope (XRF). The elemental composition was analyzed at twenty different places of the sample using 20 kV, 30 kV and 50 kV as the X-ray tube voltage. Hydrothermal ageing test was conducted in an autoclave containing superheated water steam at 180 °C and 10 bar for 12 hours to evaluate the aging resistance of the 3Y-TZP ceramics. That ageing induced tetragonal to monoclinic phase transformation was calculated by using XRD.

Studies shows that, average yttria concentration increased with increasing X-ray tube voltage. Thus, the yttria concentration of the sintered sample is increased from surface to interior. On the other hand, surface yttria concentration decreased with increasing sintering temperature from 1400 to 1500 °C. However, sintering atmosphere has a relatively weak influence on the surface yttria concentration.

The ageing studies revealed that the ageing is strongly depend on sintering temperature. Sample sintered at 1500 °C at air and argon atmosphere more susceptible to hydrothermal ageing. But sample sintered at 1400 °C at argon atmosphere shows better hydrothermal ageing compared to other samples.

*Keywords - 3Y-TZP, Zirconia ceramics, Aging, XRF, Sintering*