

## Abstract

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**Project Code :** MRG5180028

**Project Title :** Influence of Zirconia Addition on Microstructure and Mechanical Properties of Porcelain Ceramic-Nanocomposites

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**Abstract:**

The effects of  $\text{ZrO}_2$ -reinforced on the mechanical properties and crystallization behavior of leucite ( $\text{KAlSi}_2\text{O}_6$ ) in dental ceramic with the short time - one step sintering and/or tempering firing procedure were investigated. Dense dental ceramic/20 wt.%  $\text{ZrO}_2$  composites were prepared by sintering pressurelessly at  $1060\text{--}1140^\circ\text{C}$  for 25-40 min and/or tempering at  $1040^\circ\text{C}$  for 0-90 min. Microscope investigation and X-ray diffraction revealed the important role played by the  $\text{m-ZrO}_2$  phase and the formation of nanocomposite structures of dental ceramic reinforced with crystalline leucite phase. Leucite crystals were initiated and grown up from the surface of  $\text{ZrO}_2$  particles and acted as the bridge between them. Mean flexural strength and toughness of the materials can reach values of 154.6-192.8 MPa and  $2.03\text{--}2.50 \text{ MPa}\cdot\text{m}^{1/2}$ , respectively, which are higher than the dental ceramic (83.4 MPa,  $1.01 \text{ MPa}\cdot\text{m}^{1/2}$ ) alone, with the significant statistical difference ( $p < 0.001$ ). The optimum sintering and/or tempering condition could be better conciliated with the nanocomposite structures formation and can improve the strength of the composite at high temperatures and suitable dwell times.

**Keywords :** Zirconia; Dental ceramic; Sintering; Nanocomposites; Mechanical properties