Crystal structure and phase transition in SiO₂ - K₂O - CaF₂ - CaO miserite glass ceramic System

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Abstract: Miserite, as a type of calcium potassium silicate mineral, was characterized by J.D. Scott at 1975 in the form of a chain silicate structure according to 

(J₁.₂₉ [O₂.₁] Ca₅.₅₁ M₆.₄₉ \( \text{Si}_₆ (O, OH) _{₁₁₃} (Si₂ O₇) (F, OH) _₂ O.₂₉ \) ) Formula. The primary cell parameters and the positioning of all atoms in the cell were characterized by scott and he also denoted that in this structure, some impurities such as \( Y^{₃⁺}, Ce^{₃⁺}, ... \) were substituted by \( Ca^{₂⁺} \) as solid solution. Beal synthesized this composition in 1999 by glass ceramic route and reported 235 MPa, 3.5 \( MPa.m^{1/2} \) as bending strength an fracture toughness values of the products. In this research, the synthesizes of miserite based compositions by glass ceramic rout were investigated. The results of DTA and XRD study showed that the synthesis of this composition is possible just by using of some additives such as \( Ce^{₃⁺} \). Also it is denoted that using of other additives such as \( Al₂O₃ \) and \( Be₂O₃ \) beside \( Ce^{₃⁺} \) can promote the formation of miserite as major phase. The microstructure of this composition obtained as interlocked rods with 1 micron diameter and more than 20 micron length. Also it is dented that this structure can enhance the mechanical properties at the samples.

Keywords: Miserite, glass ceramic, chain silicate.

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