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## Strengthening of a Zinc Silicate Glass by Surface Crystallization

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### Abstract

Glasses with the composition  $41\text{ZnO}\cdot 49\text{SiO}_2\cdot 4\text{La}_2\text{O}_3\cdot 6\text{Al}_2\text{O}_3$  were crystallized 100K above glass transition temperature. This resulted in the surface crystallization of an unknown phase chemically close to willemite. After 20h, a  $85\mu\text{m}$  thick surface layer was formed which was composed of dendrite-like structures and an interpenetrating glass phase. The bulk glass has a coefficient of thermal expansion much larger than that of the surface layer. This leads to compressive stresses at the surface and a notable increase in the mechanical strength. After crystallization for 20h at  $800^\circ\text{C}$ , a four point bending strength of  $219\text{MPa}$  was reached while the glass shows a strength of  $73\text{MPa}$ . This may help to improve the mechanical properties of glasses and might also be important for ceramic glazes.

Keywords: Nanocrystalline materials, Crystal growth, Ceramics, Willemite, Zinc silicate

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