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**High toughness glass-ceramics in the system MgO-Al<sub>2</sub>O<sub>3</sub>-SiO<sub>2</sub>-ZrO<sub>2</sub>**

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Glass-ceramics in the MgO-Al<sub>2</sub>O<sub>3</sub>-SiO<sub>2</sub>-ZrO<sub>2</sub> system are known to exhibit high strength, toughness, hardness and elastic modulus. Due to these features, these glass-ceramics could be applied to for instance in ballistic protection - where high hardness and strength are needed - or dentistry implants, which require high toughness, strength and translucency. ZrO<sub>2</sub> acts as nucleating agent for this system leading to colorless or even translucent or transparent glass- ceramics, in contrast to glass-ceramics nucleated with TiO<sub>2</sub> or TiO<sub>2</sub> + ZrO<sub>2</sub>, which are purple to blue. In this work we investigated a MgO-Al<sub>2</sub>O<sub>3</sub>-SiO<sub>2</sub>-ZrO<sub>2</sub> glass submitted to a two-step heat treatment for nucleation and growth. Microstructure, hardness and indentation toughness (K<sub>c</sub>) were evaluated for the different glass-ceramics obtained. The crystallized fraction and crystal size were correlated to the values of indentation toughness. Our best glass-ceramic has a hardness of 9-10GPa and indentation toughness of 1.6-1.8 MPa.m<sup>1/2</sup>. This value of K<sub>c</sub> represents an increase of about 160-180% when compared with the K<sub>c</sub> of the parent glass (~1.0MPa.m<sup>1/2</sup>).