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La_2O_3掺杂对二硅酸锂微晶玻璃析晶行为和力学性能的影响

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摘 要：以P_2O_5和ZrO_2为复合成核剂，Sb_2O_3为澄清剂，通过传统熔体冷却法制得掺稀土La_2O_3的SiO_2-Li_2O-K_2O-B_2O_3系统基础玻璃。利用DSC、XRD、SEM和力学性能测试等方法研究La_2O_3含量对玻璃析晶行为、析出晶相种类及微晶玻璃力学性能的影响。结果表明：La_2O_3含量对基础玻璃的第一析晶峰对应的温度影响较大，对第二析晶峰对应的温度影响不明显；当La_2O_3的含量小于0.40%(摩尔分数)时，La_2O_3的引入不改变微晶玻璃主晶相类型；当La_2O_3含量增加到0.80%时，La_2O_3直接参与晶相组成，析出$LaPO_4$晶相；同时，La_2O_3的引入提高了二硅酸锂晶相的析出温度；当La_2O_3含量为0.40%时，微晶玻璃的抗弯强度和弹性模量达到最高值，分别为328 MPa和143 GPa；当La_2O_3含量小于0.40%和大于1.20%时，微晶玻璃的断裂韧性随La_2O_3的增加变化较小；当La_2O_3含量为0.40%~1.20%时，微晶玻璃的断裂韧性随La_2O_3含量的增加而大幅度增加，最大断裂韧性达到3.34 MPa·$m^{1/2}$。

关键字：氧化镧；二硅酸锂；微晶玻璃；力学性能

Effects of doping La_2O_3 on crystallization and mechanical properties of lithium disilicate glass-ceramics

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Abstract: The SiO_2-Li_2O-K_2O-B_2O_3 glasses doping La_2O_3 were prepared by traditional melting quenching method, using P_2O_5 and ZrO_2 as complex nucleating agent and Sb_2O_3 as clarifying agent. The effects of La_2O_3 content on the crystallization behavior, the crystalline phase and the mechanical properties of the glass-ceramics were investigated by using of DSC, XRD, SEM and mechanical property tester. The results show that, the change of La O content mainly influences

the exothermic peak temperature rather than the second exothermic peak temperature. When La_2O_3 content is lower than 0.40% (mole fraction), the doping content of La_2O_3 does not change the main crystal phase type in the glass-ceramics. However, when the La_2O_3 content increases to 0.80%, the La_2O_3 directly involves in the lattice construction of $LaPO_4$ micro-crystals. At the same time, La_2O_3 doping increases the precipitation temperature of $Li_2Si_2O_5$ phase. When the La_2O_3 content is 0.40%, the glass-ceramics has the highest bending strength and elastic modulus, which are 328 MPa and 143 GPa, respectively. When La_2O_3 content is lower than 0.40% and higher than 1.20%, the fracture toughness of the glass-ceramics changes slightly with increasing La_2O_3 content. However, when La_2O_3 content is 0.40%−1.20%, the fracture toughness increases obviously with increasing La_2O_3 content, the biggest fracture toughness of the glass-ceramics reaches up to 3.34 $MPa \cdot m^{1/2}$.

Key words: La_2O_3; lithium disilicate; glass-ceramics; mechanical properties

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