Abstract

A large amount of solid waste is generated during the stone processing, and a serious environmental issues has arisen from the accumulation of these wastes. In this work, granite powder and waste marble are used to prepare architectural glass–ceramic. The mechanical properties, microstructure, and acid resistance of glass-ceramics designed with different compositions were investigated. With the increase of waste marble content, the main crystalline phase of glass–ceramic changed from anorthite to wollastonite, and the flexural strength of glass–ceramic was also enhanced. When the mass ratio of granite powder to waste marble is 40:60, a CaO-Al_2O_3-SiO_2 (CAS) glass–ceramic with a flexural strength of 109.33MPa and a Vickers hardness of 6.61 GPa is obtained. After the addition of MgO, the main crystalline phase of the glass–ceramic is augite. Under the addition of 5wt% MgO, the flexural strength and Vickers hardness of CaO-MgO-Al_2O_3-SiO_2 (CMAS) glass–ceramic reached the maximum, which are 146.95MPa and 10.24 GPa, respectively. The mechanical properties of these two types of glass-ceramics developed from granite powder and waste marble can meet the requirements of building materials. From the acid resistance test results, it was found that the higher the content of MgO and CaO in the chemical composition of glass–ceramic, the worse the acid resistance. Therefore, the basic oxide content should be carefully controlled in the composition design of glass–ceramic. This technology of converting granite powder and waste marble into value-added glass–ceramic provides a promising method for the utilization of solid waste from stone processing, which can greatly improve the sustainability of the stone industry.