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研究论文

以冰为模板制备超轻多孔氧化锆块材

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摘要:

以冰为模板, 经真空冷冻干燥过程制备轻质ZrO_2多孔材料和水玻璃为粘结剂的超轻多孔ZrO_2块材, 研究了其微观结构、形成机理和隔热耐火性能. 结果表明, 冰是一种理想的制作多孔材料的模板, 可同时获得多种尺度的孔结构, 还可获得多孔和层状两种结构复合的微观结构. ZrO_2多孔材料的微观结构为奇特的周期性层状结构. 添加水玻璃作为粘结剂, 制备出多孔和层状两种微结构复合的ZrO_2多孔块材, 在400℃煅烧6 h后仍良好地保持原有的微观结构, 孔隙率达87%, 表观密度仅为0.50 g ? cm^{-3}, 超轻且机械强度有较大提高, 在1300℃丁烷气火焰灼烧下表现出较好的隔热耐火性能.

关键词: 无机非金属材料 氧化锆 冰为模板 多孔 超轻

Preparation and formation mechanism of porous ultralightweight zirconia by ice templating

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Abstract:

Porous lightweight ZrO_2 and porous ultralightweight ZrO_2 monolith were prepared via a freeze-drying process using ice as template. The microstructures, formation mechanisms and performances of thermal insulation and fire-resistant were studied. The results indicated that ice is an ideal template for fabrication of porous materials. The obtained porous ZrO_2 with periodical layered microstructures were lightweight, but with poor strength. After adding sodium silicate as binder, the obtained ZrO_2 monolith has porous and layered hybrid microstructures, which were still kept after calcination at 400 ^oC for 6 h. The calcined ZrO_2 monolith has a porosity of 87%, an apparent density of 0.50 g·cm−3 and high strength. The ZrO2 monolith showed good thermal insulating and fire-resistant properties with 1300^oC butane gas flame.

Keywords: inorganic non-metallic materials, zirconia, ice-templated, porous, ultralightweight

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