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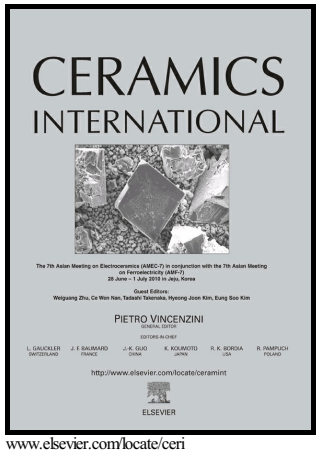

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Fabrication of high performance macroporous tubular silicon carbide gas filters by extrusion method

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Abstract: Hot gas filtration requires high performance tubular filters, but low permeability, low strength, and high sintering temperature of silicon carbide (SiC) filters limit their use. In this work, a high permeability tubular SiC support was fabricated with high strength at a sintering temperature of 1200 °C, when 100 μm SiC particles were used as aggregate, sodium dodecyl benzene sulfonate (SDBS) was used as sintering aid and organic additives were used as binders. Plasticity of the mixed particles was optimized by adjusting the ratios of methylcellulose, paraffin, and glycerol. The porosity, pore diameter, gas permeation coefficient, and bending strength of the SiC ceramic support reached 45.0%, 34.2 μm, 4.6×10^{-12} m^2, and 22.8 MPa, respectively. Furthermore, compared to the cold isostatic pressure (CIP) technique, the extrusion method led to sharper peak of the pore diameter distribution, achieved higher bending strength, and had a more homogeneous microstructure.

Keywords: Silicon carbide, Tubular support, Extrusion, Gas permeability

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Introduction

Silicon carbide (SiC) ceramic has many unique advantages, including superior wear resistance, high mechanical strength, high thermal shock resistance, and excellent corrosion resistance [1-3]. These properties ensure the suitability of SiC ceramic for the petroleum and chemical industries, medicine, metallurgy, and other fields [4]. Recently, membranes based on SiC ceramic for gas filtration have attracted growing attention [5, 6]. In general, a ceramic membrane consists of two parts: a thick support

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