

## Fabrication of Porous RBSN Ceramics with Aligned Channels by an Ice-Templating Method

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Porous ceramics are widely used for applications such as catalysis supports, gas distributors and filters such as DPF. For these purpose, it is important to have proper porosity controlling pore structure while maintaining mechanical and thermal properties. In this work, we have prepared the porous ceramic structures made of reaction bonded silicon nitride with hierarchical pore structures. Uni-directionally aligned pore channels, which are mostly filled with  $\beta$ -Si<sub>3</sub>N<sub>4</sub> whiskers, were achieved by an ice-templating method. The structures of the pore channels and the walls are controllable by the processing conditions, such as solid concentration, freezing rate of the slurry, and additives. We have investigated and characterized the influences of the conditions on the microstructures and the properties, such as porosity, pore size distribution, lamellar thickness, wavelength, and orientations. The compressive strength test and flow test was performed to determine the structural integrity and air permeability

**Keywords:** Ice-templating, Silicon nitride, Porous ceramics, Pore channels

## Effect of Nitrile-Functionalized Zwitterions on Electrochemical Properties of Electrolytes for Use in Lithium-ion Batteries

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This study examined the utility of two zwitterions, nitrile-functionalized zwitterions and a zwitterion without a nitrile group (MF-ZI), were used as additives along with 1 M LiPF<sub>6</sub> in ethylene carbonate (EC):diethylene carbonate (DEC) (3:7 V/V) (E-0) to form an electrolyte solution for use in lithium ion batteries comprising graphite and LiCoO<sub>2</sub> electrodes. The presence of NF-ZI (E-NF-ZI) in the electrolyte produced an ion conductivity comparable to that of E-0 and higher than that of an electrolyte containing MF-ZI (E-MF-ZI). Linear sweep voltammetry data revealed that the intensity of the E-NF-ZI reduction peak was lower than that of E-0. Furthermore, the successful formation of an SEI layer in the E-NF-ZI over graphite was confirmed by cyclic voltammetry data. These results were attributed to the adsorption of NF-ZI on the electrode surface, as verified by differential capacity measurements.

**Keywords:** Zwitterion, Lithium ion battery, Electrolyte