Hybrid Silicon and Carbon-Based Polymer Derived Ceramics: Processing, Characterization and Properties

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Partial thermal decomposition of hybrid Si- and C-based polymers allows for unique materials with attractive properties, such as high surface area, high electrical conductivity or specific micropore size. Potential applications include gas separation membranes and safer anodes for Li-ion batteries. The system composed of polysiloxane and polycarbosilane polymers as Si-based polymers and divinylbenzene (DVB) as C-based polymer is being explored. Samples composed of polysiloxane and polycarbosilane polymers, with DVB, were pyrolyzed at temperatures ranging from 300 to 800 degrees Celsius at one hundred-degree increments. The weight percent of DVB was increased at 10wt% increments to cover a broad spectrum of Si:C ratio in the final material. In this study the effect of pyrolysis temperature on the resultant material's microstructure and chemistry was investigated by using Fourier Transform Infrared Spectroscopy (FTIR), Raman Spectroscopy, Thermogravimetric Analysis (TGA), BET Surface Area Analysis, and Small Angle X-ray Scattering.