4th December 2020

Porous and ultrahigh surface area SiOC ceramics based on perhydropolysilazane and polysiloxane

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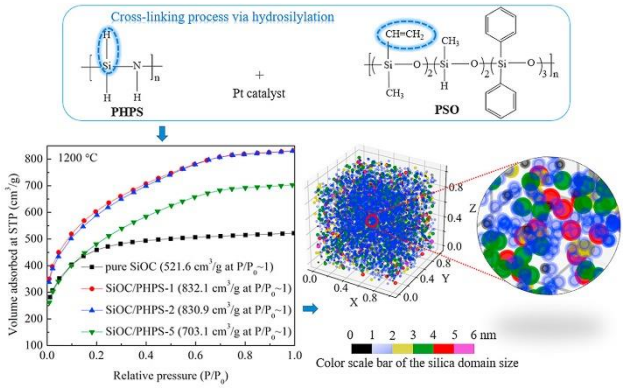
Abstract

Micro-/meso-porous ceramics with ultrahigh surface areas are highly desired in high-temperature applications. In this work, the formation of porous silicon oxycarbide (SiOC) is studied based on perhydropolysilazane (PHPS) and polysiloxane (PSO) precursors. The PHPS can be chemically anchored to the PSO by hydrosilylation reaction, due to the extensive Si–H bonds from the PHPS. The presence of water vapor during pyrolysis not only accelerates the hydrolysis of the PHPS additive but also facilitates the Si–O–Si bond formation within the SiOC. The resulting SiOC material has the highest specific surface area (SSA) of ~2000 m^2/g with an average pore size of 1.72 nm. The effects of the PHPS additive on the phase evolution and the resulting porous SiOC after hydrogen fluoride (HF) etching are investigated. 3D view of pore distributions qualitatively illustrates the PHPS effect on the SiO_2 nanocluster formation in the SiOC. The difference between the experimental and calculated SSAs is explained based on the etchability and the wall thickness of the SiO_2 domains.



Reference: Yang, Ni, and Kathy Lu. "Porous and ultrahigh surface area SiOC ceramics based on perhydropolysilazane and polysiloxane." Microporous and Mesoporous Materials 306 (2020): 110477.

Biography

Ni is a Ph.D. student in the MSE department working with prof. Kathy Lu. Her research is focused on the fundamental understanding and functionalities of polymer derived ceramic – silicon oxycarbide (SiOC). She spent her first year of graduate study at the University of Florida at Gainesville, before transfer to Virginia Tech for continuing her graduate life. She plans to graduate in December of 2020.