SCA
Synthetic Carbon Allotropes SFB953

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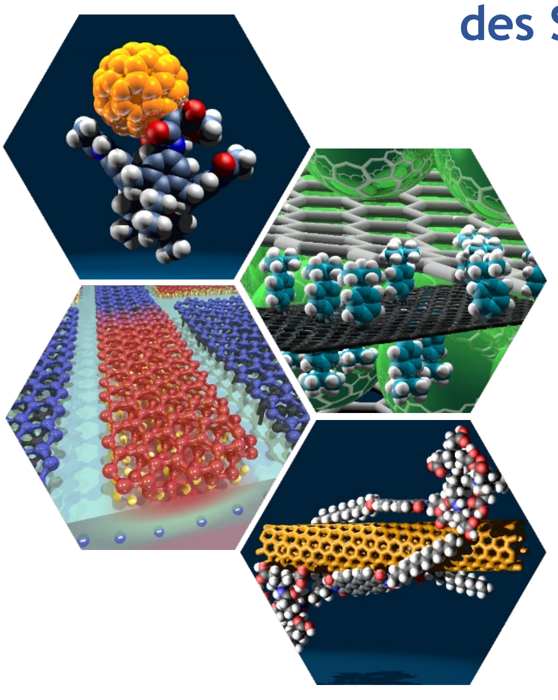

Silicon-based Hybrid Polymers from Photochemical Responses to Catalytic Recycling

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19. July 2023

14:30

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GSMS Graduate School Molecular Science
FAU Friedrich-Alexander-Universität Erlangen-Nürnberg

Silicon-based Hybrid Polymers from Photochemical Responses to Catalytic Recycling

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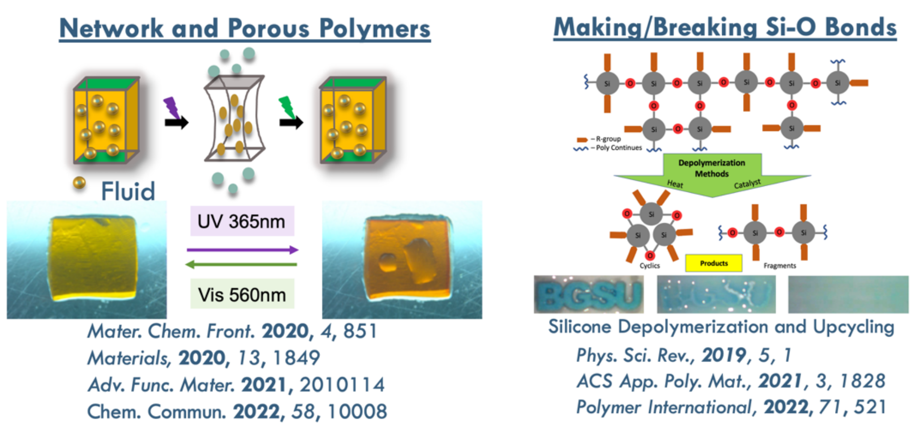
Bowling Green State University

Recent work in the Furgal Laboratory at BGSU is focused on the development of photoactive silicon-based materials with high porosity, phototriggered formation of siloxane bonds, and the recycling of preformed polymeric systems such as silicones. We have developed a set of photoswitchable Q-silica cage-based hybrid 3D polymeric smart sponges with azobenzene actuation units. Reversible UV triggered actuation of up to 18.3% has been achieved, with excellent recovery using visible light to the native state. These smart materials also offer reversible modulus switching from 160 kPa in the swollen state to 500 kPa in the UV activated state. Various substances were tested for uptake and release capabilities with polarity and size having the greatest impact on performance. This photo-triggered behavior gives these materials high potential for use as reusable environmental remediators (i.e. PFAS) and in soft robotics applications. Further work is also focused on the development of light triggerable alkoxysilanes as novel precursors for the controlled synthesis of silicon-oxygen bonds on-demand. These methods enable simple functionalization without the premature degradation that plagues most alkoxysilane derivatives and are usable in silicone 3D printing methodologies. Lastly, brief vignettes of projects relating to catalytic silicone depolymerization/upcycling and self-healing supramolecular polymers will be presented.



Photoresponsive sponge performance and silicone depolymerization/upcycling techniques.

Biography

Joseph C. Furgal received his B.S. in Chemistry from the University of Detroit Mercy, while conducting undergraduate research with M. Mio and a Snyder summer research fellowship at the University of Illinois Urbana-Champaign under the direction of J. Moore. He earned his PhD. in Materials Chemistry under the direction of Professors R. M. Laine and T. Goodson III on silsesquioxane based materials for energy/photonic applications at the University of Michigan, Ann Arbor. He then went on to a postdoctoral research position in Chemical Engineering at the University of Michigan under the direction of T. F. Scott, looking at sequence defined peptoid oligomers and their self-assembly. Joseph is currently an Associate Professor in the Department of Chemistry and Center for Photochemical Sciences at Bowling Green State University in Bowling Green, Ohio, where he was the 2022 BGSU Outstanding Early Career Investigator. His current work focuses on using hybrid (silsesquioxane and siloxane) based materials for the development and fundamental chemical understanding of photo-active architectures in the areas of switches, triggers, separations, sensors, self-healing, and environmental remediation; as well as new methods to catalytically effect molecular transformation in silicon-based systems. This research is funded by the US National Science Foundation, US National Park Service, US National Institutes of Health, Johnson and Johnson Vision Care Inc., Angstrom Technologies, and Bullen Ultrasonics.

https://furgaljc.wixsite.com/materialsworkshop