The University of Florida is seeking a company interested in commercializing a novel process for forming preceramic polymers to be used as material in burnable poison rod assemblies and/or spent fuel containers. A burnable poison rod assembly (BPRA) is a bundle of rods inserted into a nuclear reactor core during refueling to control radioactivity levels inside the reactor. However, polymers currently used for BPRAs contain boron carbide (B₄C) in an alumina matrix (Al₂O₃), chemicals that do not completely burn off the radioactive poison at the end of the reactor cycle. Although it has been known for more than a decade that using SiBCN polymers instead would leave virtually no residual poison, they are very costly and difficult to synthesize. Our researchers have developed SiBCN preceramic polymers that solve these problems and are very stable under the high-temperature conditions in a nuclear reactor.

Applications

- Nuclear-related applications including BPRAs and spent fuel containers
- Air-force and NASA applications including heat-resistant structures for launch equipment

Advantages

- Outstanding mechanical and chemical stability at very high temperatures enhances product durability
- Chemical makeup of polymer burns off poisonous waste more completely than current matrices, reducing environmentally hazardous conditions
- Streamlines processing of SiBCN-based polymer by eliminating unnecessary steps
- Ensures increased profit margins by reducing cost of processing

The Technology

In the last decade a number of materials have shown promise for enabling the production of a homogenous polymer with SiBCN components for high temperature nuclear applications. However, synthesis of these compounds tends to involve too many steps and too much complexity, at too high a cost. Researchers at the University of Florida have developed a method for forming SiBCN-based polymers to be used as BPRAs in nuclear reactors or in other extreme temperature conditions. These polymers will save energy companies and launch equipment manufacturers significant time and money.
Cost-Effective SiBCN Polymers for Nuclear Reactors

The Inventors

Jongsang Lee, a University of Florida researcher focused on polymer synthesis and composites, received his undergraduate and Master’s degrees from the Chungnam National University Polymer Science and Engineering Department, and is completing his Ph.D at UF’s Department of Materials Science and Engineering. Mr. Lee previously conducted research at the Division of Material Research in the Korea Institute of Science and Technology’s Center for Polymer Hybrids. At Taekwang Institute of Technology he was a field engineer for the Division of Carbon Fiber Research in Carbon Fiber & Composite Materials Lab and Carbon Fiber Plant, then a senior researcher in the Division of Polyester Research in the Synthetic Fiber Lab.

Ronald Baney (at right in photo), Associate Engineer at the University of Florida Department of Materials Science and Engineering, earned his BS in Chemistry from Alma College and his Ph.D in Inorganic Chemistry from the University of Wisconsin. Dr. Baney joined Dow Corning in 1959 and worked in various positions in the research of silicon containing materials. For most of Dr. Baney’s career (1959-1996), he focused on new venture activities for Dow Corning, including starting a major ceramic effort and investigations into dielectric materials. As assistant research director at the Japan Research Center, Dow Corning Asia, he initiated a global new research thrust into network silicone materials and held the title of global expertise center leader of rigid materials. Dr. Baney was selected for the first Dow Corning industrial sabbatical leave at Cambridge University with professor E. Ebsworth in 1965-6 and at Nagoya University with professor S. Hirano as an honored visiting industrial scientist in 1985-6. In addition to his formidable industrial career, Dr. Baney has authored 23 publications, 4 book chapters (with 2 more in press), and co-edited one book. He holds 40 patents.