Researcher collaborates with industry to create design tool for syntactic foams

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Syntactic foams, which have been used for years in aerospace and marine applications, are being employed in a wider and wider array of products. Nikhil Gupta, NYU Tandon professor of aerospace and mechanical engineering has partnered with specialty chemical makers Dixie Chemical and Evonik to create a web-based tool that lets product manufacturers create the right kind of syntactic foam for a specific product. Credit: NYU Tandon School of Engineering

With a foundation in aerospace and deep-sea applications, syntactic foams are emerging in the construction, infrastructure, wind energy, and sports equipment industries. Companies in the transportation sector are also employing these super-light, strong materials to build more efficient, less costly vehicles.

Nikhil Gupta, NYU Tandon professor of mechanical and aerospace engineering and a leading researcher in lightweight materials and specialty chemicals, is working with chemical companies to make it easier for manufacturers to make the right kind of syntactic foam for their products.

Syntactic foams are composite materials fabricated by mixing tiny spheres of glass or ceramic—called microballoons—into precursor materials such as polyethylene or epoxy. But one size does not fit all: the optimal proportion of ingredients depends on the end products and such variables as the temperature, pressure, physical impact, and water exposure to which they will be subjected.

To help take the guesswork out of that process, Gupta collaborated with Dixie Chemical, a major producer of anhydride curatives for epoxy syntactic foams, and specialty chemical maker Evonik to develop a new online tool, Design Syntactic, that simplifies, accelerates and improves syntactic foam material design.

The tool, which incorporates theoretical equations developed by Gupta and his team, allows a user to input variables and retrieve algorithmically derived results for proper proportions of constituent microballoons and precursor materials. For example, if a user inputs thermal specifications for a product, they will get a thermal expansion coefficient; if mechanical properties, they will receive parameters for qualities like stiffness.

Gupta explained that the tool, based on a multifunctional syntactic foam for which he received a patent this year, allows users to determine the volume fraction of particles to mix with the plastic that will result in syntactic foam exhibiting the desired properties.

"We offer a rigorous, patented design tool using established peer-reviewed and industry-accepted theory and models, so that users can develop an optimum formulation, thereby reducing the time and effort required to bring a product to the market," Gupta said.

Mike Gromacki, President of Dixie Chemical, said, "With our financial support and technical contribution, NYU has created and freely shared this tool with our industry, thus reducing technical barriers, ensuring robust design of foam systems, and opening new markets for these remarkable materials."

Gupta recently collaborated with the National Institute of Technology-Karnataka (NIT-K), India, to study the means by which smaller plastic-component manufacturers can more easily produce syntactic foams for cars and consumer goods.

Provided by NYU Tandon School of Engineering