6th International Conference and Exhibition on
Mechanical & Aerospace Engineering
November 07-08, 2018 | Atlanta, USA

Enhanced processing and hybridization of silica aerogel composites

Sunil Chandrakant Joshi and **P Manikandan**
Nanyang Technological University, Singapore

Silica aerogels are synthetically-produced, ultra-light-weight, insulating materials. These are available in, either granular or wrapped-in blanket forms. In these forms, however, the material is either fragile or sheds dust particles during handling and site use. Another novel form, recently developed, is a composite of the silica aerogel granules bound together using a non-toxic, non-hazardous, water-soluble binding agent. These composites are equally light-weight, good heat insulators, sound reducers and water-resistant. This paper presents our study on these eco-friendly silica aerogel composites carried out to enhance their processing, manufacturability, dimensional accuracy and mechanical performance. Appropriate close mold designs were conceptualized and built to avoid out-of-plane deformations or warping of the composite blocks during the fabrication process. The samples produced using these new molds are perfectly flat. This is a step forward such that any conforming shape now can be produced. In addition, the new mold design is compact and facilitates simultaneous fabrication of more samples. The silica aerogel composites are generally rigid. Investigations were conducted using specific fillers and reinforcement to enhance the flexibility of these composites. Solid and liquid additives, namely fumed silica, carbon nanotubes and methyltrimethoxysilane (MTMS) were tried. Their effects were studied using 3-point bending and cyclic compression tests. Additionally, a physical reinforcement in the form of the woven thermoplastic mesh and the glass woven fabric was studied. The impact of these was examined using the standard mechanical properties tests. It was observed that fumed silica helped enhance compression behavior while the glass fiber reinforcement provided better flexibility. The mechanical performance was found enhanced by two-fold. The proposed talk will touch upon the concept developments, mold design, reinforcing procedures, test results and accomplishments and the underlying reasons.

Biography

Sunil ChandraKant Joshi is a faculty in the School of Mechanical and Aerospace Engineering of Nanyang Technological University Singapore. He received his PhD from Monash University, Australia, for his work on composites manufacturing processes. His research includes aerospace composites and structures, multi-functional composites, numerical simulation composites manufacturing processes, autoclave molding, filament winding, microwave curing, braided composites, environmental effects and engineered composites. The silica aerogel composite technology, mentioned in this talk, has resulted in a US patent (No. 9, 764, 301, 19th Sep, 2017) and been licensed to a company for thermal and acoustic insulation market. He has successfully supervised over 150 project students (including 8 PhDs) and has about 200 publications and reports to his credit.

mscjoshi@ntu.edu.sg

Notes: