

HiPerDuCT Programme Grant

Final report: High performance but ductile matrices

Aerogel modified matrices

Where existing materials are not adequate, our emerging understanding is that stiff, yet plastic matrices with strong strain hardening characteristics will be desirable. Bi-continuous hybrid aerogel-polymer matrices (Figure 1) may provide a nano-reinforcement which both reduces stress concentrations at broken primary fibres and a strain hardening response in shear [1, 2]. Fibre breaks should be localised but allowed to slide to a limited extent, to introduce (pseudo)ductility. It is envisaged that the highest benefit in use of aerogel-matrix reinforced fibre composites will be in compression where lateral stiffening to limit fibre micro-buckling is promoted [3, 4].

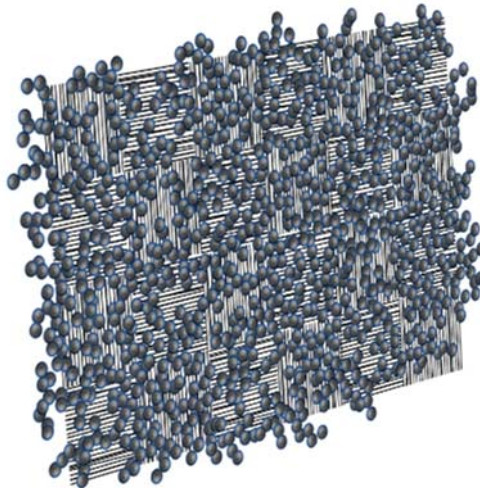


Figure 1. Schematic of woven fabric embedded in an aerogel.

References

- [1] Qian H, Nguyen S, Anthony D B, Singh A, Xu S, Greenhalgh ES, Bismarck A, Shaffer M SP, 2015, Stiff monolithic aerogel matrices for structural fibre composites, *20th International Conference on Composite Materials (ICCM20)*, Copenhagen, Denmark. Paper ID: 5212-4
- [2] Bismarck A, Blaker J J, Anthony D B, Qian H, Maples H A, Robinson P, Shaffer M SP, Greenhalgh ES, 2016, [Development of novel composites through fibre and interface/interphase modification](#), *37th Risø International Symposium on Materials Science IOP Publishing, IOP Conf. Series: Materials Science and Engineering* **139** 012001. DOI: 10.1088/1757-899x/139/1/012001
- [3] Nguyen S, Anthony D B, Qian H, Yue C, Singh A, Shaffer M SP, Greenhalgh E S, Bismarck A, Mechanical performance of carbon aerogel reinforced carbon fibre hierarchical composites, *In preparation*
- [4] Nguyen S, Anthony D B, Qian H, Xu S, Shaffer M SP, Greenhalgh E S, Bismarck A, Silica Aerogel Infused Hierarchical Glass Fiber Polymer Composites, *In preparation*