Capacity Area A3 Topic 3.2 Milestone 1 & Deliverable 1

Dissemination of results on the development of bioinspired ceramic composites

Significant steps have been made in realising bio-inspired design of hierarchical architecture composite materials. By studying brick and mortar composites at the scale of a model system, the research has been able to establish quantitative design guidelines that describe the role of connectivity and multiscale architecture on the stiffness, strength and toughness of such materials. The resulting materials outperform all other known model systems in terms of combining these properties. Because this was achieved by tuning only due their structural motif, so the findings can readily be translated to industrial composites for lightweight applications where resilience is vital.

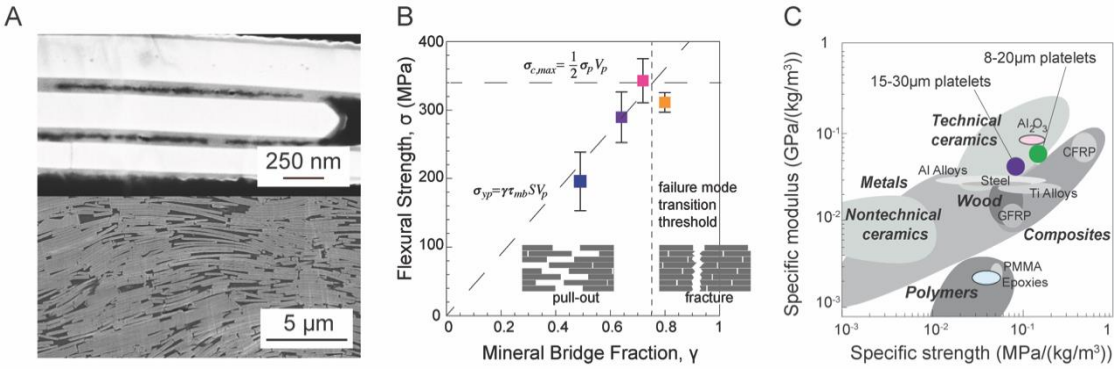

Figure. Nacre-like polymer matrix composites. (A) Scanning electron micrographs of the mineral bridge nano-structure and brick and mortar microstructure. (B) Quantitative structure-property relationships between relative mineral bridge strength and composite flexural strength. (C) These materials are the record-holders in the field, with higher specific stiffness and strength than GFRP or steel.

These important results have been presented to the scientific community (dissemination). See the list below for specific dissemination and reporting highlights:

1. Grossman, M., Bouville, F., Masania, K. & Studart, A. R. "On the Fracture Mechanics of Multiscale Nacre-like Composites". Presented at Gordon Research Conference on Bioinspired Materials, Les Diablerets, Switzerland, 2018.
2. Grossman, M., Bouville, F., Masania, K. & Studart, A. R. "Quantifying the role of mineral bridges on the fracture resistance of nacre-like composites". Presented at The 18th European Conference Of Composite Materials Greece, 2018.
3. Grossman, M. "Processing and Fracture Mechanics of Multiscale Nacre-like Composites». (3rd Sept) PhD Thesis Defence 2018.

Report on structure property relation of bioinspired ceramic composites

The reporting consists of three parts, namely two journal publications in review processes and the thesis of Ms Grossman-Watson, which provides an overarching contextualisation of the work as well as scientific aspects.

1. Grossman, M., Bouville, F., Masania, K. & Studart, A. R. "Quantifying the role of mineral bridges on the fracture resistance of nacre-like composites" (in Revision, PNAS) 2018.
2. Grossman, M., Bouville, F., Dransfeld, C. Masania, K. & A.R. Studart. "Hierarchical toughening of Nacre like Composites" (Submitted) 2018.
3. Grossman, M. "Processing and Fracture Mechanics of Multiscale Nacre-like Composites». (3rd Sept) PhD Thesis 2018.