CA: A3 Topic: Demonstrator parts fabricated using promising approaches
Deliverable / Milestone Code: A3.2.2-3

The approach developed in this project for the fabrication of high-performance composites involves the magnetic assembly of TiO_2-coated alumina platelets into ceramic green bodies exhibiting brick and mortar microstructure, followed by hot-pressing to obtain interconnected mineral scaffolds, and infiltration with an organic phase to form a nacre-like composite material. During hot-pressing, the titania coating partially sinters into nanoscale-contacts between platelets; modulating the temperature produces different levels of mineral interconnectivity. Because this process incorporates platelets of predefined size, it is now possible to match their size and aspect ratio to the submicron scale of the biological material. We investigate the role of mineral interconnectivity in nacre-like composites at an order of magnitude smaller than was previously possible in composites built from freeze cast scaffolds. This combination of fine structure and nano-interconnectivity simultaneously increases the elastic modulus, strength and fracture toughness to levels unprecedented in nacre-like composites, shedding light on the crucial role of mineral bridges in the mechanical behaviour of nacre.

Figure 1. Picture of the bulk ceramic green body with nacre-like microstructure obtained by the fabrication route developed in the SCCER project.