

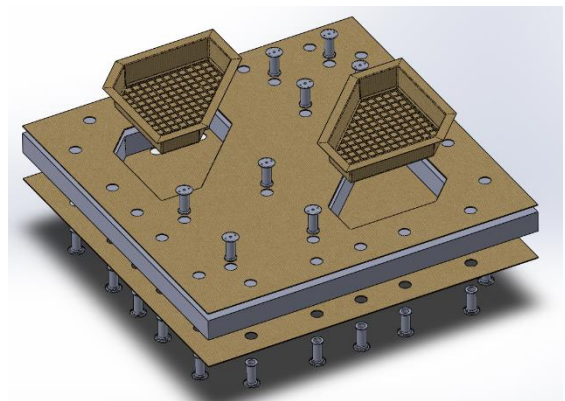
ESA GSTP

Bio-composite structures in space applications

Under 2018-2020 ESA GSTP funding, Bcomp Ltd. and RUAG Space jointly designed and built a spacecraft structure demonstrator panel from **ampliTex™** flax fibre-reinforced composite facesheets (FFRP) and aluminium honeycomb core (AHC) under the same specifications as a standard aluminium / AHC panel. The reference design, mechanical and environmental requirements were inspired from the Sentinel-1 satellite's secondary structure.

With the project successfully concluded, Bcomp natural fibre composite technologies are now mature at TRL 6 for space applications. At component level, the FFRP/AHC panel is validated at TRL 5, and a full-scale demonstrator would bring it to TRL 6 as well.

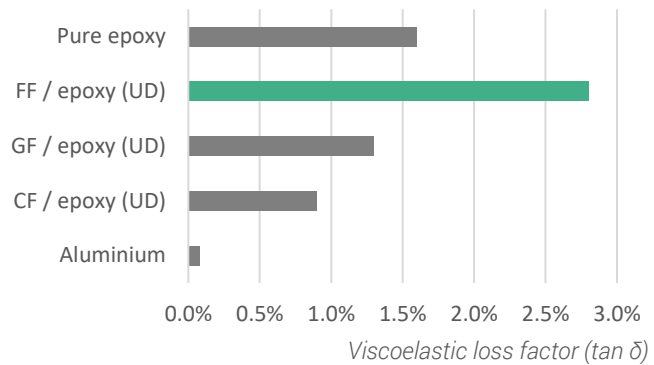
The very good demisability behaviour of FFRP was demonstrated in plasma wind tunnel testing at the IRS Stuttgart PWK-4 facility. Compared to carbon fibre-PEEK composites (CFRP), its ablation rate under the same heat flux conditions was exceptional thanks to its propensity for spallation, whereas CF strands tend to remain in place as the matrix demises around them.



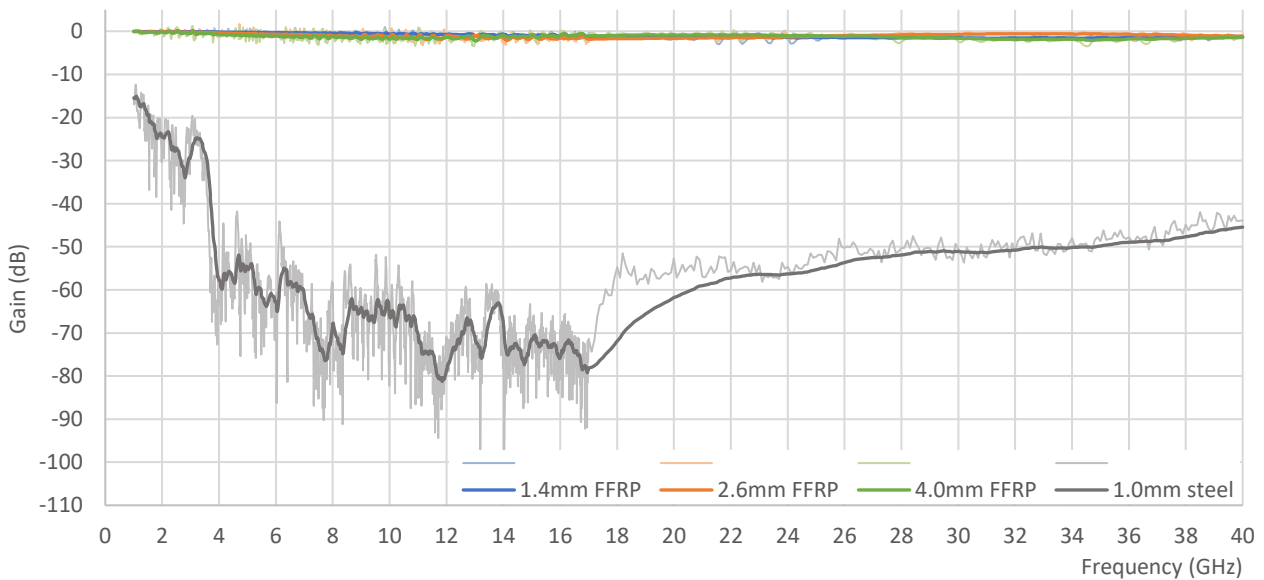
Exploded view of the FFRP / AHC panel demonstrator with powerRibs™ recessed features

On that basis, novel design features were introduced as a new opportunity for Design-for-Demise, allowed by the natural fibre-based **powerRibs™** thin-shell composite reinforcement technology: single-shelled recessions in the sandwich panel surface, intended to act as targeted demisable points for the early ingress of heat fluxes into the satellite's internals upon re-entry.

FFRP has shown to provide many advantages over CFRP as a composite reinforcement: a significantly lower environmental impact at material level, much better demising behaviour, improved vibration damping and high radio-transparency. However, the lower specific modulus of flax fibres often implies a weight penalty vs CFRP structures designed to meet high in-plane stiffness requirements.



Where out-of-plane (flexural) rigidity is the design driver however, FFRP/AHC panels can meet the stiffness requirements of an all-aluminium panel with little-to-no weight penalty. Theoretical analysis also suggests that such panels should provide equal or improved protection against hypervelocity impact events.

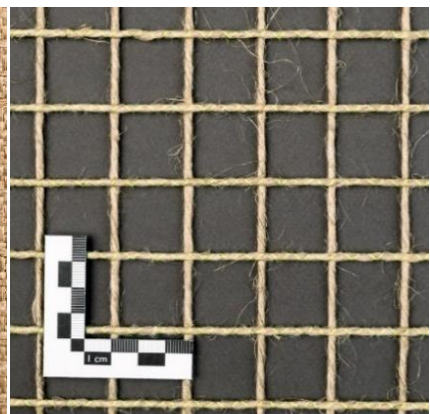
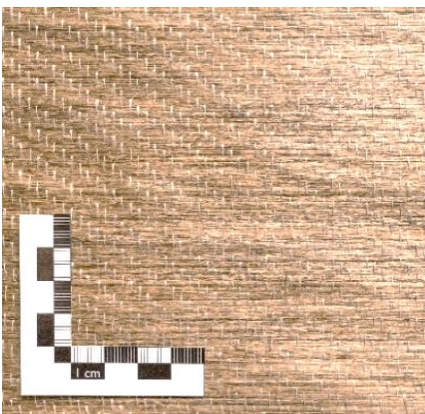


RF transmission through various thicknesses of FFRP vs. 1 mm steel plate, up to K_a band.

ampliTex™ 5057
No twist UD, 150 gsm

ampliTex™ 5040
Twill 2-2, 200/300 gsm

powerRibs™ 5022
Patented 3D reinforcement grid



Bcomp's flagship natural fibre reinforcement solutions for high specific stiffness applications, available dry or as prepregs for auto-clave processes.