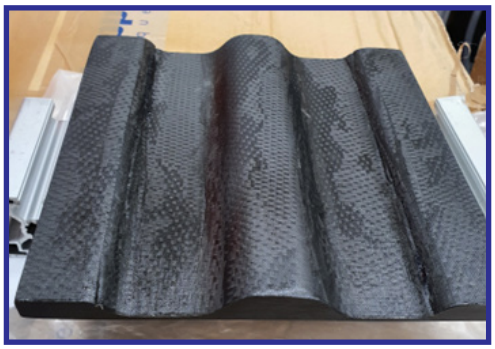
Composites UK
Trade Association

BRUNEL COMPOSITES CENTRE

INNOVATION IN COMPOSITE MANUFACTURE

FINALIST: HyPStore Project



HyPStore delivers a first-of-its-kind linerless Type-V cryogenic hydrogen tank, combining graphene-enhanced composites, robotic filament winding, and self-healing technology in a single, scalable manufacturing process. Graphene nanoplatelets (GNPs), produced from recycled agricultural plastics via Flash Joule Heating, are embedded directly into the resin, improving gas barrier performance, reducing microcracking under repeated thermal cycling, and enhancing cryogenic durability. Robotic multi-axial layup ensures precise fibre architecture, optimal resin distribution, and leak-before-break structural behaviour. Integrated self-healing microcapsules provide autonomous damage mitigation, extending service life without additional processing.

The innovation eliminates the need for metallic or polymer liners, simplifying recycling, reducing material interfaces, and lowering system weight by 30–40%, while maintaining structural integrity under extreme cryogenic conditions (-253°C). End-users in aerospace, defence, and clean energy benefit from improved payload efficiency, reduced certification effort, and simplified manufacturing through one-shot composite production.

HyPStore demonstrates cutting-edge technology by embedding barrier and structural performance into the material itself, rather than relying on added liners or bonded layers. Development involved lab-scale validation, thermal cycling, leak-before-break modelling, robotic winding trials, and near full-scale demonstrators. Specialist skills in nanomaterials, composite mechanics, cryogenic engineering, and structural simulation were essential to its success.

The innovation targets the global hydrogen storage market, projected to exceed £1.36B by 2028, with initial commercial potential capturing ~4% of Type-V tanks (~£39.6M revenue, £7.9M profit in five years). By integrating circular sourcing, high-performance composites, and scalable manufacturing, HyPStore provides a sustainable, lightweight, and high-integrity solution, accelerating adoption of hydrogen as a clean, high-energy fuel across advanced mobility, aerospace, and energy sectors.

Learn more at: www.brunel.ac.uk/research/projects/hypstore-advancing-low-carbon-hydrogen-production-and-safe-storage-for-mobility