

Cevotec, Roth and Cikoni achieved 15% mass reduction and 17% increased storage efficiency for H₂ tanks

Cevotec has partnered with a tank manufacturer, winding equipment provider Roth Composite Machinery and the composite engineering service provider CIKONI to investigate and showcase the effect of dome reinforcements using Fiber Patch Placement technology for composite tanks.

Cevotec has developed an industrial solution to reduce the amount of carbon fiber needed for a composite tank by locally reinforcing the tank's dome areas. Fiber Patch Placement (FPP) is the first technology to lay-up dome reinforcements directly onto the liner using a fully automated, industrial process which can be combined with established wet or towpreg winding equipment.

This approach reduces net fiber usage by approx. 15%, depending on the vessel characteristics, which translates into considerable weight and material cost savings while maintaining equivalent mechanical properties. Due to the material reduction, the reinforced tanks also feature more storage volume in the same build space and an improved CO₂ footprint.

To underpin Cevotec's approach, an optimized full-scale demonstrator has been successfully developed in collaboration with the project partners. The primary goal was to optimize the fiber lay-up to reduce weight, cost and production time. The project comprised all aspects from laminate design, simulation and optimization to the actual production and testing of the reinforced composite tanks. Additionally, the effectiveness of FPP dome reinforcements within an industrial production environment has been evaluated. With the successful completion of the third design iteration, the intended results have been achieved.

"The 300 bar type IV tank has a thinner composite overwrap with a lower number of layers to be replaced by dome reinforcements. which is a challenging set-up compared to 700-bar-class vessels.", states Dr. Florian Lenz, Technical Director of Cevotec. "To achieve the optimal material saving design, different laminate iterations were pursued. In a third iteration, we successfully achieved the burst safety factor of 108% and material savings of 15%." Due to the material savings, the CO₂ footprint is significantly reduced and the storage efficiency of the test vessel can be increased to 6.1 %, which represents an improvement of 17 % compared to the storage efficiency of the reference vessel.

Cevotec is currently assembling a dedicated FPP production system for dome reinforcements in their lab in Unterhaching near Munich. This SAMBA Pro PV lab system will be available for commercial prototyping and development with customers in spring 2024. Thorsten Groene, CEO and Co-Founder at Cevotec, underlines the strategic relevance of industrial dome reinforcements: "The expected fiber demand for H₂ tanks will outgrow available fiber supply in the next 5-10 years. Technologies like FPP that enable resource savings are strategically important for global competitiveness." Interested parties can meet the Cevotec team at booth M99 in hall 5 during JEC World in Paris, March 5-7, together with their partner GFM GmbH.