

Addressing the Challenge of Corrosion in Downhole Tubing and Casing Applications

Non-metallic Innovation Centre brings together TWI and DNV GL to develop first industry guidelines for composite tubing and casing in downhole oil and gas

Leading players in the oil and gas industry, TWI and DNV GL, have come together under the auspices of the Non-metallic Innovation Centre (NIC) to address the significant challenge of corrosion in downhole tubing and casing applications in the oil and gas industry. For example, the annual cost of this in relation to tubing was estimated by NACE at \$463 million in 2018, representing over 33% of the total cost of corrosion in the oil and gas industry.

Fibre reinforced polymer pipes, however, offer an alternative solution because they are corrosion free and provide a number of benefits, such as higher strength to weight ratio when compared to metallic pipes; smoother bore that reduces rig capacity requirements; and the potential to be spoolable making them easier to transport and install than metallic pipes. In addition, the application of non-metallics can lead to cost savings due to reduced workflow and interventions, greater well integrity, improved safety levels and lower environmental risk.

Despite the tangible benefits of using composite materials, there is still a reluctance to use non-metallic tubing in casing in the oil and gas industry but, working together, TWI and DNV GL have identified that the main barrier to their application is the lack of rigorous design and qualification practices, which would serve to minimise the risk of pre-mature failure and provide operators with confidence in technology adoption.

Furthermore, adaptation of the failure envelope approach for steel pipes, as in standard API 5C2/C3 for non-metallic pipes, requires substantial effort and resource as it necessitates a large amount of full-scale testing. This makes qualification of such products impractical, costly and time-consuming.

To address these challenges, the NIC has invested in a TWI – DNV GL collaboration that will see them jointly develop the first industry guidelines for the design and qualification of composite tubing and casing for downhole oil and gas applications. These will lead to a reduction in the amount of full-scale testing required, providing a toolkit with which to optimise associated costs and engender a higher level of confidence in overall product performance.

The guidelines will utilise experience from across the value chain of composite pipes, and state-of-the-art design pyramid practices developed in DNV GL composite standards such as DNV GL-ST-C501 and DNVGL-ST-F119. The design pyramid approach is a multi-scale modelling and testing scheme which includes testing at different scales and connecting them by models. It

has been successfully developed and tried in DNV GL-ST-F119 for Thermoplastic Composite Pipes (TCP) in past years with multiple TCP products already fully qualified and in service.

The first phase of this Joint Industry Project (JIP) is due to commence in summer 2020 and will include around ten participants from the oil and value chain.

Mihalis Kazilas, NIC Program Director said: “TWI is delighted to come together with DNV GL for this project on which we can pool our many years’ expertise and experience in the oil and gas industry.” “We believe that the guidelines we plan to develop are essential in enabling the deployment and adoption of non-metallic tubing and casing, and will also serve to accelerate and support the development of new products.” he added.

Principal Specialist, Fracture Mechanics and Non-metallics, DNV GL Ramin Moslemian said, “DNV GL is happy to work with TWI and other partners in this JIP to expand the use of composite tubulars to downhole applications, using the multi-scale methodology of our standards for composite components.”