

Degradation of Mechanical Properties of Offshoring Polymer Composite Pipes in Thermal Environment

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Abstract : Composite pipes are commonly used in the oil industry, and extreme flow of hot and cold gas fluid can cause degradation of their mechanical performance and properties. Therefore, it is necessary to consider thermomechanical behavior as an important parameter in designing these tubular structures. In this paper, an experimental study is conducted on composite glass/epoxy tubes, with a thickness of 6.2 mm and 86 mm internal diameter made by filament winding of ($\Phi = \pm 55^\circ$), to investigate the effects of extreme thermal condition on their mechanical properties over a temperature range from -40 to 80°C. The climatic chamber is used for the thermal aging and then, combine split disk system is used to perform tensile tests on these composite pipes. Thermal aging is carried out for 8hr but each specimen was subjected to various temperature ranges and then, uniaxial tensile test is conducted to evaluate their mechanical performance. Experimental results show degradation in the mechanical properties of composite pipes with an increase in temperature. The rigidity of pipes increases progressively with a decrease in thermal load and results in a radical decrease in their elongation before fracture, thus, decreasing their ductility. However, with an increase in the temperature, there is a decrease in the yield strength and an increase in yield strain, which confirmed an increase in the plasticity of composite pipes.

Keywords : composite pipes, thermal-mechanical properties, filament winding, thermal degradation

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