

Analytical failure analysis of bio/synthetic sandwich pipe under pressure

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Abstract – The objective of this study is to evaluate the potential applications of eco friendly-composites based on natural fibers. An analytical model has been developed in the present research to investigate the mechanical behavior of sandwich pipes under internal pressure loading. The proposed model gives an accurate solution for stresses, strains, and displacement on a sandwich pipe consisting of epoxy for the core layer and reinforced materials with an alternative ply for the skin layers. The purpose of this study is to evaluate the potential applications of three natural fibers, which are pineapple leaf fiber (PALF), Alfa, and jute bio fibers in replacing synthetic glass fiber used in sandwich pipes. The solutions are obtained by using the MATLAB numerical code. The TSAI-WU criterion was used to provide a failure analysis on this subject. The distributions of stress, strain, and displacement through the thickness of the skins and core are shown. Progressive strengthening of layer numbers was chosen to raise the rigidity of a bio-composite sandwich and reduce the gap compared to a synthetic sandwich, which allowed for optimal behavior. The ultimate pressure and safety factors earned by increasing the number of biocomposite layers are important for composite transportation pressure pipelines, especially for sandwich pipes based on PALF/epoxy.

Keywords – Sandwich Pipes, Biocomposite, Synthetic Composite, Internal Pressure, And Analytical Methods