Main Objective

This project was awarded to West Virginia University in order to investigate advanced composite pipes made of pultruded and filament wound Glass Fiber Reinforced Polymers (GFRP) as a viable alternative/complementary material to steel for high pressure transmission lines. Investigation of burst pressures of GFRP pipes will be done through experimental methods.

Project Approach/Scope

Major tasks to achieve the objective of the project are:
❖ Hydrostatic Burst Pressure Testing of GFRP pipe and joints
❖ Analysis of GFRP pipe and joint behavior
❖ Prediction of mechanical behavior and failure mechanisms
❖ Characterization of GFRP pipes and joints

Manufacturing

Process of making GFRP wound pipes are:
❖ Fibers are wetted by running through a resin bath
❖ Wet fibers are wound around a mandrel
❖ Curing is activated by applying heat to the pipe
❖ Shrink wrap is wrapped around pipe to insure a void free surface

Results to Date

i. Pultruded pipes burst at a lower pressure than the fiber wound pipes.
ii. Three fiber wound pipes of 3/8” wall thickness were tested and yielded an average burst pressure of 2,957 psi, while three 3/4” thick pipes yielded an average burst pressure of 4,814 psi.
   • Failure of wound pipes were due to local delaminations on the interior barrier layer.
   • Failure stress was within 10% of analytical prediction
iii. Two GFRP wrapped butt joints were tested and failed at 50% of pipe pressure.
   • Joint failures were due to a delamination of the external GFRP wrap and a leak on the edge of the external wrap.

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References


Public Project Page

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