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RESEARCH ARTICLE

Studies of FRP butt joint and welded joint by using Universal testing machine

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ABSTRACT : Structural material finds application in various industries, such as shipbuilding pressure vessel, bridge construction industries etc. The joining of two components together is an important and essential aspect of fabrication and erection. Every structure includes assemble materials into more complex shape. Often joint of a pipeline is the weakest link, as strength of joint is lower than strength of parent material, for example, joint of structural application with the welding, the failure occurs in most of the cases at the welded region. In critical applications, the assembly team is responsible for avoiding its failure; however, there is need to check the welded joint on a regular time interval. Many different kind of techniques are available to join the pipelines of various industries. These are broadly classified as bolting, welding, brazing and soldering, adhesive bonding etc. The winding machine is developed to wind coarsely woven fabric (600 g s m) found to be quite satisfactory, when tested under three point bending test on universal testing machine (UTM). To make a fiber reinforcement polymer (FRP) joint, the E-glass fibre is cut into an appropriate trapezoidal shape, which is wetted in epoxy and wound over steel pipe. The FRP sleeve thus obtained is of uniform thickness in its central position. Experiments are performed on different piles on pipes. In this study, a butt-joint between two mild steel pipes of $25.29^{+0.05}_{-}$ mm outside diameter and $2.00^{+0.05}_{-}$ mm thickness wall thickness was made by wrapping a glass fiber fabric. The fabric was wetted in epoxy before it wrapped around the joint. The joint was tested under different load condition, three point bend test, four point bend test, and tensile test. The strength of the FRP-joint was compared with the strength of welded joints.

Key words : FRP, Composite material, Three point bend test, Weld joint

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INTRODUCTION

Fiber reinforced polymer (FRP) composites is defined as a combination of fiber glass or carbon and a polymer matrix, which provides reinforcement in one or more direction. FRP composites differ from the traditional structural materials, such as steel or aluminum. FRP composites have an isotropic properties, *i.e.* properties apparent only in the direction of the fibers, while other traditional materials have isotropic properties *i.e.* uniform properties in all directions. The industrial application of composite material is specific to the need of operation and/or environment, in which that operation takes place. Fiber reinforced composites are widely used in aircrafts, rockets and automotive structures, for their better advantage of lower weight, high strength and stiffness. Composite materials, such as fiberglass reinforced thermoset plastics have been used in piping systems over 40 years. Most of the composite pipes of conventional circular cross-section are manufactured by filament winding. Filament winding is the process by which fibers are layered onto a rotating mandrel, building the wall of the pipe layer-by-layer. This is an effective means to produce a pipe with good mechanical properties because the fibers are in tension, as they are layered onto the pipe and the operator is able to control the angle that they are layered and can, therefore, optimize the final product. However, current methods of filament winding are not conducive to manufacturing a pipe with a non-circular cross-section, such as rectangular, triangular and semi-circular etc. Components produced by the hand lay-up method, in which sheets of fabric are wetted with resin and wrapped by

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