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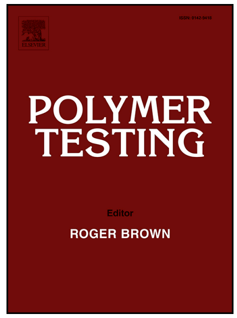

Long-term behavior of GFRP pipes: Optimizing the distribution of failure points during testing

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Test Method

Long-term behavior of GFRP pipes: Optimizing the distribution of failure points during testing

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Abstract
The certification of glass-fiber reinforced plastic (GFRP) piping systems isregulatedbynormative standards in which test series of 10,000 hare needed to predict the residualproperty of the expected life (normally, 50 years). In this paper, optimization of statistical distribution of the testisproposed. This system involves using orthogonal design and test schemeslasting under 10,000h. Experimental results for long-term ring-bending strain(S_b) of GFRP pipes from the standard test procedure indicated that this system is practical and effective.Theestimation error when usingthe proposedmethod was consistentlyless than 8% if compared to thestandard method.
*Keywords:*GFRP pipes; long-term ring-bending strain; residual propertyprediction; statistical distribution; orthogonal design

1 Introduction

GFRP pipes have been used in the chemical industry, and for ducts, offshore facilities,water distribution systems and sewage systems.The normative standards of GFRP piping systemsrequire test series lasting 10,000 hto evaluate the residualproperties and the expected life of the system (normally, 50 years). Shorter but still reliable ways of estimating residualproperties would encourage industrial improvement and innovation of products and lead to greater utilization to avoid over-design, and also help users to perform confirmation tests. Quickerand more effective test schemesthan can be standardized are urgently required by the GFRP piping industry.

Double-log regression analysis has been the dominant model for the prediction of the 50-year properties of GFRP pipes,[1–4] but regression parametersmust be estimated from the experimental data gathered over a long period ofapproximately 10,000h, and the distribution of failure points must be selected as follows:[2–4]

Hours to failure	Points of failure
10 to 1000	at least 4

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