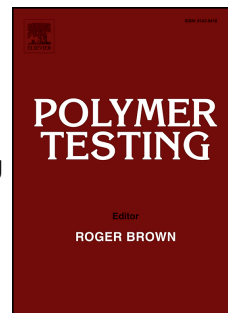


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Test Method

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 is regulated by normative standards in which test series of 10,000 h are needed to predict the residual property of the expected life (normally, 50 years). In this paper, optimization of statistical distribution of the test is proposed. This system involves using orthogonal design and test schemes lasting under 10,000 h. 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. The estimation error when using the proposed method was consistently less than 8% if compared to the standard method.

Keywords: GFRP pipes; long-term ring-bending strain; residual property prediction; 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 systems require test series lasting 10,000 h to evaluate the residual properties and the expected life of the system (normally, 50 years). Shorter but still reliable ways of estimating residual properties 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. Quicker and more effective test schemes than 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 parameters must be estimated from the experimental data gathered over a long period of approximately 10,000 h, 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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