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Using developed creep constitutive model for optimum design of HDPE pipes

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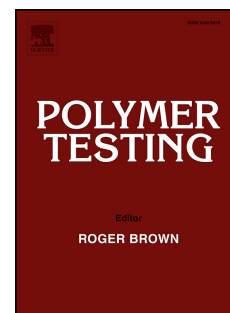
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Property Modelling

Using developed creep constitutive model for optimum design of HDPE
pipes

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Abstract

Unlike metal pipes, high density polyethylene (HDPE) pipes are not susceptible to erosion and corrosion. However, the most important mechanical feature of the HDPE pipes is that this material creeps even at room temperature. Therefore, it is essential to study the creep behavior of this material in order to develop a model. In this paper, creep behavior of HDPE at different temperature and stress levels has been experimentally studied to obtain the creep constitutive parameters of the material. These parameters are used to predict the creep behavior of different structures such as HDPE pipes. For this purpose, a number of specimens have been machined from industrial manufactured pipe walls. Uniaxial creep tests have been carried out and creep strain curves with time for each test were recorded. Then, a constitutive model is proposed for HDPE based on the experimental data and optimization methods. The results of this model have been compared with the test data and good agreement is observed. The developed constitutive model and reference stress method (RSM) were used to produce graphs which provide optimum creep lifetime and design conditions for HDPE pipes that are subjected to combined internal pressure and rotation. These graphs can facilitate the design process of HDPE pipes.

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