Matériaux & Techniques

2013, Pages 0-0

Short-term HDPE pipe degradation upon exposure to aggressiveenvironments

L. Alimi, K. Chaoui, W. Ghabeche, W. Chaoui

Abstract: Natural gas and drinkable water are regularly transported by underground polyethylene pipenetworks in urban and rural areas. The interaction between materials such as high density polyethylene(HDPE) and contact environments is a critical factor which strongly influences pipe behaviour for short andlong terms. The aim of this study is to establish separate effects of H2SO4, a mixture of toluene–methanoland distilled water on the mechanical properties of HDPE pipes. Two testing geometries representing thepipe wall are considered: (1) orthogonally machined filaments and (2) ASTM standard specimens. Tensiletests are carried out on both specimen types using a computer controlled Zwick machine. It is observedthat chemical environments degrade mechanical properties causing a structural weakening especially thosespecimens exposed to organic solvent and acid. For instance, filaments show a reduction in elastic modulusof 64% after 7 days of exposure to toluene and methanol. Compared to standard specimens, the obtainedproperties are much higher indicating that geometry has an effect on the measured values. Fluctuationsin mechanical properties are most probably caused by cristallinity gradients all the way through the pipewall. This type of results allowed establishing the linear relationship between the elastic modulus and theyield stress and is intended to contribute to a better understanding of properties heterogeneity effects whenexposed to unfavourable environments.

Keywords : polyethylene pipe, environmental stress effect, short-term degradation, yield stress-Young’s modulus correlations, failure strain, OIT