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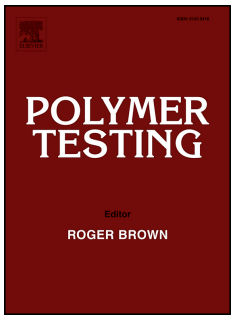

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Material Behaviour

Accelerated Water Tree Aging of Crosslinked Polyethylene with Different Degrees of Crosslinking

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Abstract

The effect of crosslinking degree on accelerated water tree aging in crosslinked polyethylene (XLPE) was investigated. The peroxide-crosslinking process was adopted to make XLPE specimens with different degrees of crosslinking by controlling the doping content of dicumyl peroxide (DCP) in low-density polyethylene (LDPE). The water blade electrode method was applied to accelerate water-tree aging of LDPE and XLPE specimens (hereafter referred to as the specimens), and their morphologies were observed using an optical microscope. The variation of crystalline morphology and anti-cracking performance of the amorphous region in the specimens were analyzed by differential scanning calorimetry (DSC), scanning electron microscopy (SEM) and an electronic universal testing machine. Based on the experimental results, it was found that XLPE has great anti-water-treeing performance compared to LDPE. In addition, the higher the crosslinking degree, the better the anti-water-treeing performance. Although crystal growth is inhibited due to the crosslinking reaction, the density of tie molecular chains greatly increases in the amorphous region and exhibits significantly tighter lamellar stacking, which is the reason that water tree growth is restrained with increasing crosslinking degree.

Keywords: XLPE; accelerated water-tree aging; crosslinking degree; water blade electrode method

1. Introduction

XLPE is widely applied in the insulation of power cable due to its good processability and convenient operation and maintenance. However, in wet environments, the initiation and propagation of water trees in XLPE insulation is one of the main aging phenomena in power cable, resulting in the degradation of mechanical and dielectric properties [1-5]. In addition, a water tree is likely to