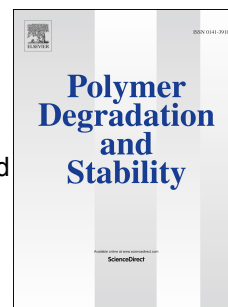


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Absorption kinetics and swelling stresses in hydrothermally aged epoxies investigated by photoelastic image analysis.

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Abstract.

The present work proposes an experimental optical methodology able to measure the transient swelling stresses induced by the water uptake aging of polymers. In particular, the work describes the implementation of a Photoelastic technique to quantify internal stresses arising during the hydrothermal aging of cast epoxy samples. The material investigated is a model DGEBA/DDS epoxy system. Curing and post-curing cycles have been optimised in order to obtain a fully cured, high T_g , and completely stress free initial condition. Rectangular beam samples were then left in a hydrothermal bath at 90 °C, and regularly monitored by gravimetric and photoelastic analyses. The quantitative evolution of stresses induced by water ingress was obtained by a Photoelastic Stress Analysis technique applied during water absorption, and successive desorption in controlled conditions. The evolution of stresses is correlated with gravimetric data, allowing to gain a new insight to investigate the complex swelling and diffusion kinetics of water ingress into thermoset polymer networks.

Keywords: Hydrothermal Aging; Swelling Stresses; Photoelastic Stress Analysis; Thermosetting Resin.

1. INTRODUCTION

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