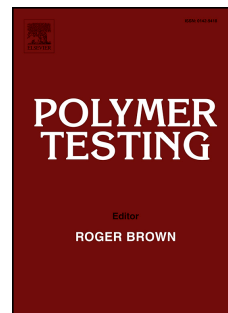


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TOWARDS SELF-DIAGNOSIS COMPOSITES: DETECTION OF MOISTURE DIFFUSION THROUGH EPOXY BY EMBEDDED EVANESCENT WAVE OPTICAL FIBRE SENSORS

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Abstract

This paper reports on an epoxy matrix for glass fibre reinforced polymers equipped with low cost optical fibre sensors for the early detection of water diffusion, with devised applications in the oil and gas industry. Novel evanescent wave optical fibre sensors were designed, fabricated and embedded in epoxy resin samples. The tips of the optical fibre sensors were coated with a silver layer to work in reflection, so that they could be used as probes. Accelerated diffusion tests were performed: the samples were exposed to simulated sea water at 80 °C for up to 148 hours. The water diffusion resulted in a remarkable change of the reflected signal from the sensors, a result that was then confirmed through gravimetric measurements and a theoretical prediction, according to Fick's diffusion law. The results corroborate the feasibility of "sensitive" fibre reinforced polymers in harsh environments and that chemicals diffusion in these materials can be remotely and continuously monitored by means of the presented sensing system.

Keywords Optical fibre sensors; Polymer composites; Structural health monitoring; Moisture diffusion.

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