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ON THE ESTIMATES OF DURABILITY OF GLASS FIBRE REINFORCED POLYMERS SUBJECTED TO HOT /WET AGING

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Summary: This paper presents the effects of hot /wet aging on the durability of glass Fibre Reinforced Polymers (FRPs). A complete experimental work on the assessment of durability after hygrothermal aging was conducted by means of physical, chemical and mechanical analysis. FRP samples were subjected to hot /wet aging for a period of up to 224 days. Samples were aged in distilled water at 25ºC, 40ºC, 60ºC and 80ºC. Moisture absorption behaviour was followed with gravimetric measurements which led to the determination of both bulk and directional diffusivities via Fickian modeling. Changes in tensile and shear mechanical properties during aging were examined at pre-described time intervals. Dynamic Mechanical Thermal Analysis (DMTA) was employed to both aged and reference materials in order to track any Glass transition temperature (Tg) variation due to exposure. Physicochemical changes during aging are mirrored in the Tg values. To enhance the understanding upon the effects of aging on a chemical basis, Scanning Electron Microscopy (SEM), Energy Dispersive Spectroscopy (EDS) and Infrared Spectroscopy (FT-IR) were employed revealing significant chemical decomposition occurring even after the very first days of immersion in water. Finally, Computed Tomography (CT-scan) scanning was successful in pin-pointing internal imperfections in reference materials as well as the location of moisture after in samples after hygrothermal aging. Experimental results exhibited a preferential diffusion of moisture along the fibre reinforcement direction. Also, prolonged aging at elevated temperatures induced physical and chemical degradation which did not affect significantly the initial mechanical properties.