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Tensile behaviour of uncured Sheet Moulding Compounds: rheology and flow-induced microstructures

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Abstract – During compression moulding, Sheet Moulding Compounds (SMCs) are subjected to tensile strains that yield detrimental tears. To understand these mechanisms, tensile experiments were performed with two uncured industrial SMC formulations with low and high pore and fibre contents. These experiments were coupled with Digital Image Correlation to estimate mesoscale strain fields on the sample surface. X-ray microtomography was used to obtain 3D *ex situ* evolutions of pores and fibre-bundle orientation. Both formulations behaved as porous, elastoviscoplastic, anisotropic and shear thinning fluids, showing strain hardening followed by softening and sample breakage. During stretching, SMCs dilated with anisotropic pore growth, whereas fibre bundles aligned along the tensile direction following the prediction of the modified Jeffery's equation. In addition, the ductility of SMCs was largely altered both by the initial pore contents and fibre-bundle flocs/aggregates induced during the prepreg fabrication, the latter leading to undesirable strain localisation bands enhancing sample breakage.

Keywords – A. Prepreg, D. X-ray microtomography, D. Mechanical Testing, E. Compression moulding

1. Introduction

Sheet moulding compounds (SMC) are thermoset prepregs that are widely used in the automotive, aeronautics and electrical industries. They exhibit excellent properties for a

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