

## Multi-Scale Damage and Mechanical Behavior of Sheet Molding Compound Composites Subjected to Fatigue, Dynamic, and Post-Fatigue Dynamic Loadings

**Authors :** M. Shirinbayan, J. Fitoussi, N. Abbasnezhad, A. Lucas, A. Tcharkhtchi

**Abstract :** Sheet Molding Compounds (SMCs) with special microstructures are very attractive to use in automobile structures especially when they are accidentally subjected to collision type accidents because of their high energy absorption capacity. These are materials designated as standard SMC, Advanced Sheet Molding Compounds (A-SMC), Low-Density SMC (LD-SMC) and etc. In this study, testing methods have been performed to compare the mechanical responses and damage phenomena of SMC, LD-SMC, and A-SMC under quasi-static and high strain rate tensile tests. The paper also aims at investigating the effect of an initial pre-damage induced by fatigue on the tensile dynamic behavior of A-SMC. In the case of SMCs and A-SMCs, whatever the fibers orientation and applied strain rate are, the first observed phenomenon of damage corresponds to decohesion of the fiber-matrix interface which is followed by coalescence and multiplication of these micro-cracks and their propagations. For LD-SMCs, damage mechanisms depend on the presence of Hollow Glass Microspheres (HGM) and fibers orientation.

**Keywords :** SMC, Sheet Molding Compound, LD-SMC, Low-Density SMC, A-SMC, Advanced Sheet Molding Compounds, HGM, Hollow Glass Microspheres, damage

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