

Impact properties of NBR/HDPE based composites reinforced with polystyrene and vermiculite for aeronautics

Violeta Yotova¹, Olga Klinkova², Emin Bayraktar³, Dimitar Dontchev⁴

¹ ISAE-Supméca / UTCM, Sofia, France. violeta.yotova@isae-supmeca.fr

² ISAE-Supméca, France. olga.klinkova@isae-supmeca.fr

³ ISAE-Supméca, France. emin.bayraktar@isae-supmeca.fr

⁴ UTCM, Sofia, Bulgaria. dontchev@utcm.edu

Paper ID: 90

[Symposium S2: Mechanics of composites: Experiments and modelling](#)

[Extended Abstract](#)

Abstract

This study investigates the damping properties of sustainable high-density polyethylene (HDPE) and nitrile-butadiene rubber (NBR)-based composites reinforced with polystyrene (PS) or vermiculite (VRM) particles. Composite specimens were produced by hot compaction after incorporating 5, 10 and 15 wt.% of PS or VRM filler into a rubber-modified HDPE matrix. Drop-weight impact tests were carried out according to ASTM D7136-20, and the absorbed energy was determined from the force–time curve. The neat HDPE/NBR matrix absorbed 62 J, whereas the composite containing 10 wt.% of PS achieved the highest energy absorption, reaching 72.5 J. Fracture surface analysis by Scanning Electron Microscope (SEM) revealed typical polymer damage mechanisms, including ductile tearing and micro void formation in the matrix, as well as filler-driven crack interactions that influenced the overall failure mode. The results demonstrate that an intermediate PS content provides the most effective balance between ductility and reinforcement, identifying HDPE/NBR–PS composites as promising candidates for impact-resistant aeronautical structures.

Keywords:

Polymer-based composites Sustainable rubber Damping properties Aeronautics materials