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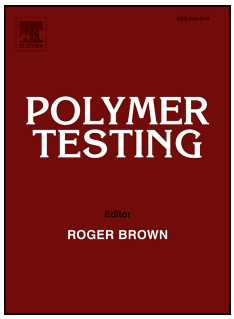

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Mechanics of material removal when cutting natural fiber reinforced thermoplastic composites

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ABSTRACT

This paper aims to study the machinability of natural fiber reinforced thermoplastic composites by investigating the mechanics of chip formation and the multiscale cut surface's quality induced by the orthogonal cutting process. Unidirectional flax fibers reinforced polypropylene (UDF/PP) composite has been tested by orthogonal cutting experiments. Mechanical tensile and shear tests have been conducted on UDF/PP specimens to relate the mechanical behavior to the cutting behavior.

Results show that UDF/PP composites produce a continuous chip at all the considered cutting conditions. This is inherently related to the specific mechanical behavior of flax fibers inside the thermoplastic matrix under cutting solicitations. The cutting behavior induces a consequent surface damages in the form of debonding zones and uncut fiber extremities. Results demonstrate that the cutting depth has the most significant influence on the machinability after sorting the pertinent scales of the cut surface using the multiscale surface analysis approach.

KEYWORDS

Natural fibers; Thermoplastic composites; Machining process; Mechanical testing; Chip formation; Multiscale surface analysis.

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