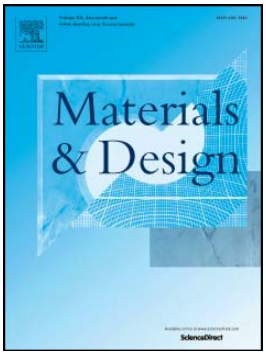

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Awa S. Doumbia, Mickaël Castro, Denis Jouannet, Antoine Kervoëlen, Thierry Falher, Laurent Cauret, Alain Bourmaud

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Awa S. Doumbia[1], Mickaël Castro[2], Denis Jouannet[1], Antoine Kervoëlen[2], Thierry Falher[1], Laurent Cauret[1] and Alain Bourmaud[2]

[1] Institut Supérieur de Plasturgie d'Alençon (ISPA). Pôle Universitaire de Montfoulon – BP 823 – 61041 Alençon Cedex.

[2]Laboratoire d'Ingénierie et Matériaux de Bretagne (UBS), Université Européenne de Bretagne, Centre de Recherche Christiaan Huygens, Rue Saint Maudé, 56321, Lorient, France

Corresponding author: *E-mail address alain.bourmaud@univ-ubs.fr*
Tel.: +33-2-97-87-45-18; fax: +33-2-97-87-45-88

ABSTRACT

The optimization of the processing method for poly-(propylene) (PP)/plant fibre composites compounding is a key point in the development of semi-structural parts, especially for automotive applications. The aim of this original and innovating work is to study, at different scales, the impact of extrusion equipment and fibre length on the composite's mechanical performances. Firstly, we studied the flax fibre morphology after compounding and injection as well as their individualization in injected specimens. Secondly, we focused on the effects they had on tensile properties. The impact of the processing tool was observed on fibre morphology and division; as well as the use of a BUSS system instead of a twin-screw extruder, which enhances the fibre individualization, however, the number of kneading areas should be reduced in order to preserve the reinforcement aspect ratio. We highlight the fact that the composite's mechanical performances are highly impacted by the fibre division and cell wall stiffness, as demonstrated by *in-situ* nanoindentation tests. Finally, the use of longer fibres is not a priority for the improvement of mechanical performances; it induces a more difficult fibre division and an increase in the compound viscosity, which could endanger the moulding process of the final part.

Key words: Injection moulding; Flax fibre; Poly-(propylene); Microstructure; Mechanical properties; Nanoindentation.