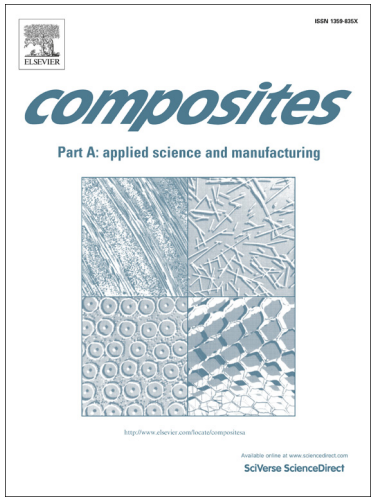
Accepted Manuscript



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PII: S1359-835X(15)00468-6
DOI: http://dx.doi.org/10.1016/j.compositesa.2015.12.004
Reference: JCOMA 4159

To appear in: *Composites: Part A*

Received Date: 6 July 2015
Revised Date: 1 December 2015
Accepted Date: 11 December 2015

Please cite this article as: Lionetto, F., Dell'Anna, R., Montagna, F., Maffezzoli, A., Modeling of continuous ultrasonic impregnation and consolidation of thermoplastic matrix composites, *Composites: Part A* (2015), doi: http://dx.doi.org/10.1016/j.compositesa.2015.12.004

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Abstract

Ultrasonic propagation was used to provide heat and pressure in order to perform impregnation and consolidation during production of thermoplastic matrix composites. For this purpose, a new experimental set-up, integrating a laboratory filament winding machine with a horn and a compaction roller, was developed.

The heat transfer phenomena occurring during continuous impregnation and consolidation were simulated solving by finite element (FE) analysis the energy balance equations in 2D accounting for the heat generated by ultrasonic waves, the melting characteristics of the matrix and the movement of the thermoplastic commingled roving.

The temperature distribution in the composite, predicted by the numerical simulations, was validated by temperature measurements during the production of E-glass/polypropylene cylinders, with the optimized parameters obtained by the FE analysis. The ultrasonic consolidated composite cylinders were characterized by low void content and a shear modulus comparable with that obtained by the micromechanical analysis.