Accepted Manuscript

Effect of temperature on static and low velocity impact properties of thermoplastic composites

Luigi Sorrentino, Davi Silva de Vasconcellos, Marco D'Auria, Fabrizio Sarasini, Jacopo Tirillò

PII: S1359-8368(16)32400-3

DOI: 10.1016/j.compositesb.2017.01.010

Reference: JCOMB 4821

To appear in: *Composites Part B*

Received Date: 22 October 2016

Revised Date: 9 December 2016

Accepted Date: 8 January 2017

Please cite this article as: Sorrentino L, de Vasconcellos DS, D'Auria M, Sarasini F, Tirillò J, Effect of temperature on static and low velocity impact properties of thermoplastic composites, *Composites Part B* (2017), doi: 10.1016/j.compositesb.2017.01.010.

Effect of Temperature on Static and Low Velocity Impact Properties of Thermoplastic Composites

Luigi Sorrentino[1,*], Davi Silva de Vasconcellos[1], Marco D'Auria[1], Fabrizio Sarasini[2], Jacopo Tirillò[2]

[1]*Istituto per i Polimeri, Compositi e Biomateriali, Consiglio Nazionale delle Ricerche, P.le E. Fermi 1, 80055 Portici (NA), Italy*
[2]*Dipartimento di Ingegneria Chimica, Materiali e Ambiente and UDR INSTM, Università di Roma La Sapienza, Via Eudossiana 18, 00184, Roma, Italy*

*Corresponding author (Luigi Sorrentino): luigi.sorrentino@cnr.it, Tel. +390817758844, Fax +390817758850

ABSTRACT

In this work, thermoplastic composites based on poly(ethylene 2,6-naphthalate) (PEN) have been investigated with the aim to elucidate the effect of temperature on static and impact properties. The matrix was reinforced with four different high performing woven fabrics based on carbon, Twaron, Vectran, basalt fibres. Composites were manufactured by using the film stacking technique, alternating layers of balanced plain weave fabrics (0/90) and films of amorphous PEN, keeping the fibre volume fraction around 40%. The compression moulding process was optimized to obtain optimal fabric impregnation and to keep the void content lower than 1%. The structural response was evaluated at 20 °C, 60 °C and 100 °C by means of static flexural and low velocity impact tests. Dynamic mechanical scans (DMA) were also performed to evaluate the stiffness of the laminates at temperatures ranging from – 80 °C to 230 °C. The flexural modulus and strength of laminates resulted to be very high in proportion with the fibre stiffness. The flexural behaviour was affected by the temperature but a limited reduction of the stiffness (lower than 20%) was exhibited by all but PEN/Vectran up to temperatures of 100 °C. PEN/carbon resulted the best performing system at each testing temperature (flexural modulus equal to 38.8 GPa, flexural strength equal to 714 MPa at 20 °C). Results from DMA tests demonstrated a satisfactory agreement with static tests (differences within ± 13%, except that for PEN/Vectran). The impact resistance of the composites was found to depend on the fibre type, temperature and interface strength. PEN/basalt resulted the best performing composite followed by PEN/Twaron (perforation energy at 20 °C: 44.3 J and 38.2 J, respectively). The PEN/carbon laminate exhibited the lowest impact performance but, unlike PEN/basalt and PEN/Vectran, the impact resistance improved with the increasing temperature.