

Accepted Manuscript

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PII: S0263-8223(17)32769-1

DOI: <https://doi.org/10.1016/j.compstruct.2018.05.109>

Reference: COST 9748

To appear in: *Composite Structures*

Received Date: 29 August 2017

Revised Date: 7 March 2018

Accepted Date: 18 May 2018



Please cite this article as: Wang, W., Zhang, X., Chouw, N., Li, Z., Shi, Y., Strain rate effect on the dynamic tensile behaviour of flax fibre reinforced polymer, *Composite Structures* (2018), doi: <https://doi.org/10.1016/j.compstruct.2018.05.109>

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Strain rate effect on the dynamic tensile behaviour of flax fibre reinforced polymer

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Abstract

Flax fibre reinforced polymer (FFRP) has been heavily studied in terms of static properties. To study its dynamic behaviour, experimental work also needs to be carried out. This study presents the tensile properties of flax fibre reinforced polymer (FFRP) composite under static and dynamic loadings. Experiments and Weibull distribution analysis were performed to investigate the strain rate effect on the dynamic properties of FFRP composites. In total, 45 specimens were considered. Dynamic tensile tests were performed by using a high-speed servo-hydraulic testing machine with a strain rate ranging from 0.764 s^{-1} to 135.68 s^{-1} . Empirical formulas of dynamic increase factor (DIF) were derived at various strain rates. Weibull distribution analysis was applied to quantify the variability of tensile strength at different strain rates. Failure process and failure modes of FFRP were discussed via analysing high-speed camera recording. The results show that the tensile strength, failure strain, DIF and energy absorption of FFRP increased with the strain rate when it was higher than 79.12 s^{-1} .

Keywords: flax fibre reinforced polymer, dynamic tensile test, strain rate effect, dynamic increase factor

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