Influence of Thermal Shock on the Dynamic Mechanical Properties of Flax Fiber Reinforced Epoxy Polymer Composites

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Abstract

In the present study the investigation of the influence of thermal shock cycling on the dynamic mechanical properties of epoxy matrix composites reinforced with flax fibers. For this purpose Plates of epoxy resin-flax composites after polymerization were constructed and specimens were cut in the desired dimensions in order to be tested in dynamic mechanical and static loading. The samples have been exposed to a certain number of thermal cycles at a temperature range from -40^{o}C to +28^{o}C. Dynamic mechanical analysis tests were performed in pristine and thermally shocked specimens in order to determine the viscoelastic response of the material and time-temperature superposition principle was used to generate master curves. Thermal fatigue lowered storage modulus, loss modulus and damping factor values when compared to the non-thermal shocked samples. However, thermal shock conditions greater than 100 cycles did not affect the dynamic moduli by a statistically significant amount. In other words, there is seems to be a certain number of thermal cycles below which damage increases rabidly, reaching a point where saturation of microdamage is attained. Likewise, glass transition temperature was affected by increasing testing frequency range and shifted to higher temperatures. However, Tg values, for all samples, showed minor variation as the thermal cycling increased. Finally, master curves obtained, successfully, by applying time-temperature superposition principle (TTSP), confirming the viscoelastic parameters'' strong dependence on frequency.

References

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