

## **Thermo-Elastic Temperature-Dependent Properties of a Polymer Matrix Composite (PMC). Material Parametric Study using DIGIMAT Software.**

### **Executive Summary**

The objective of this work is to predict the macroscopic engineering constants (Young's Modulus, Coefficient of Thermal Expansion, ...) of a temperature-dependent PMCs where the polymer matrix is reinforced with glass fibers.

DIGIMAT analyses were successfully performed to predict the influence of the temperature on the composite's en (i.e. Young's Modulus (E) and Thermal Expansion Coefficient ( $\alpha$ )) in the longitudinal ( $E_L$ ,  $\alpha_L$ ) and transversal ( $E_T$ ,  $\alpha_T$ ) directions to the test sample.

The predicted values compare very favorably to experimental results.

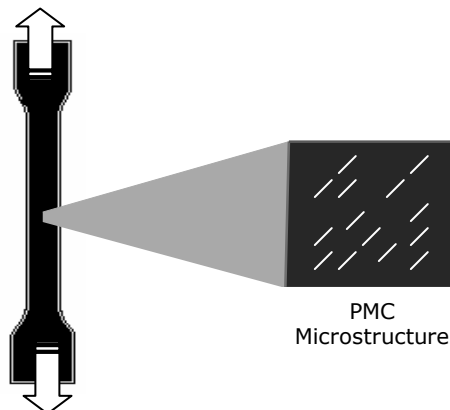
### **Problem Definition**

The matrix and fiber's materials have temperature dependent properties (see following figures).

Here are the composite's design parameters.

#### Design Parameters: Fibers'

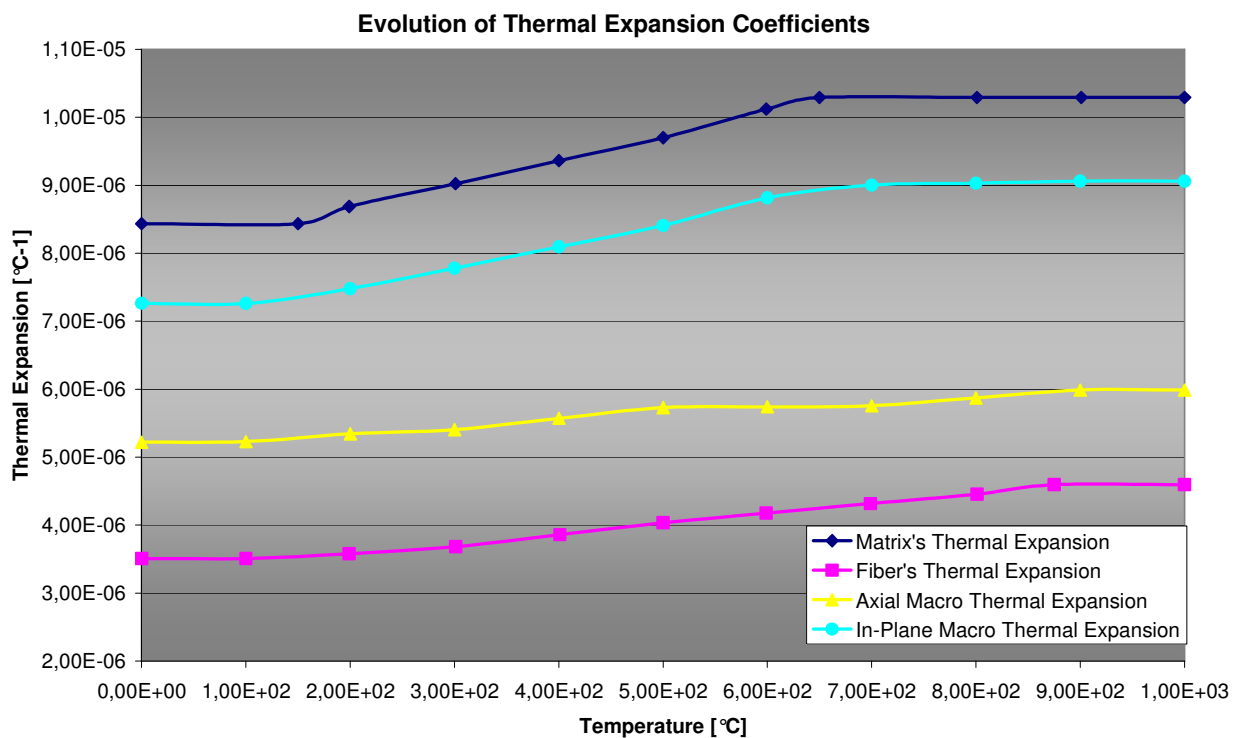
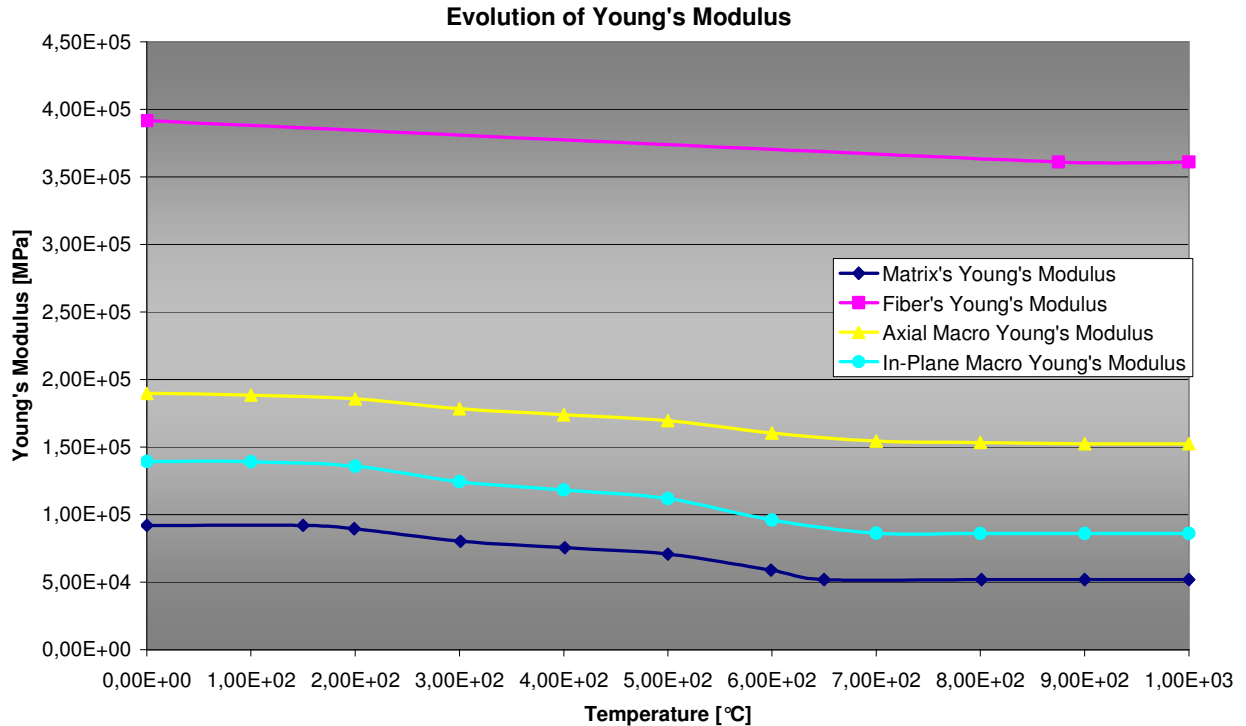
1. Aspect Ratio (AR=1.e4, long fibers)
2. Volume Fraction (VF=32.5%)
3. Orientation ( $\phi=0^\circ$ , aligned with traction direction)



## Results

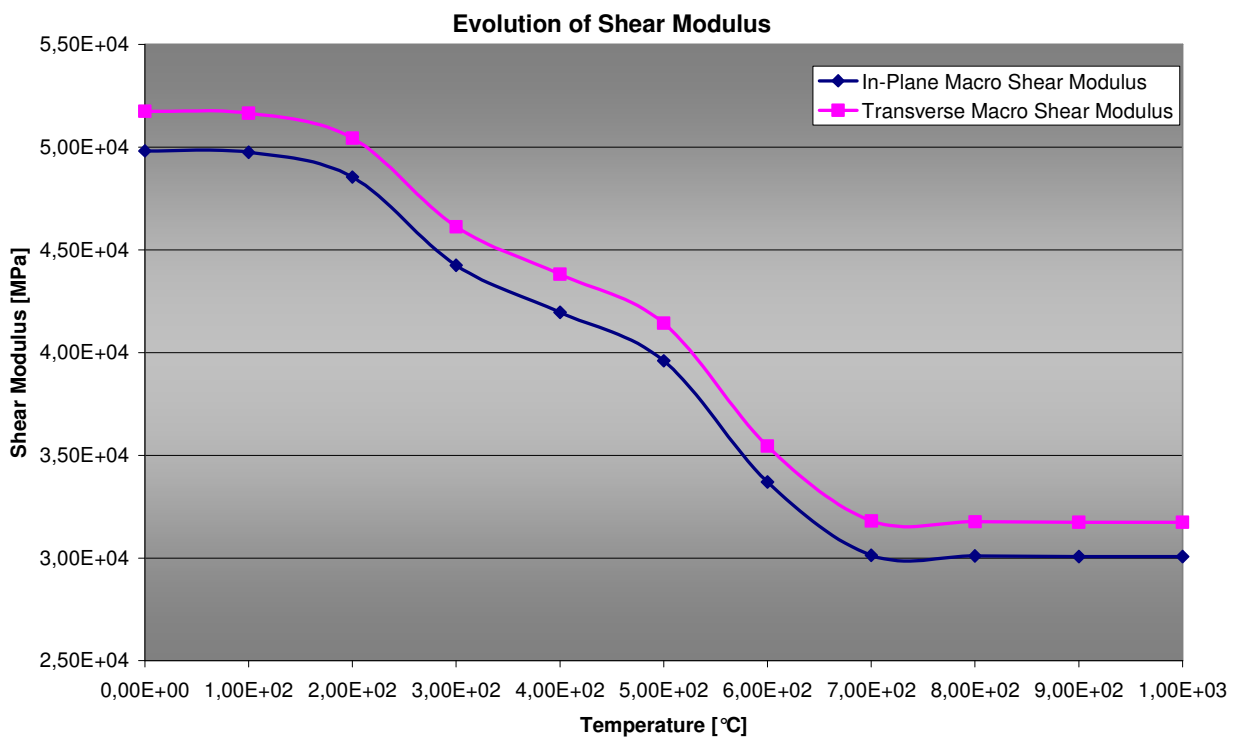
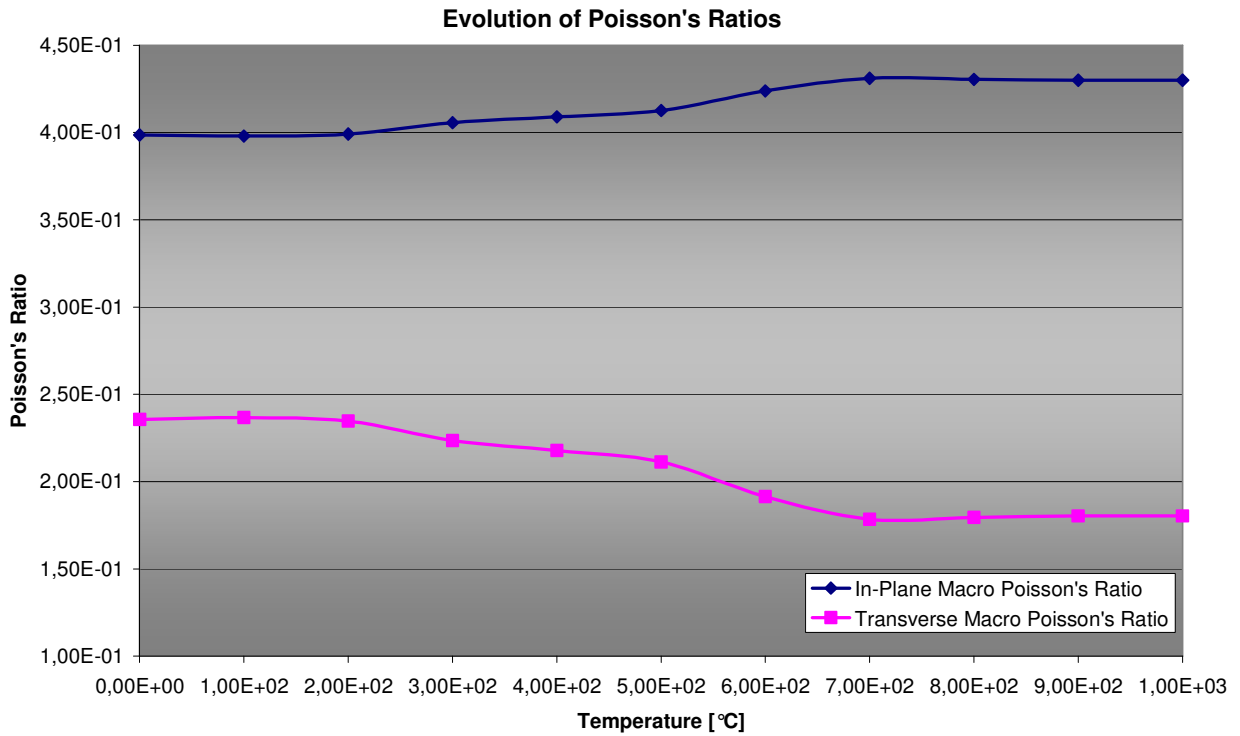
The charts presented here summarize DIGIMAT prediction of engineer constants.

Each data point corresponds to a DIGIMAT analysis which requires less than a CPU second to complete on a regular PC.



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