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Composites reinforced with glass fibers or carbon fibers are widely used in various sectors such as transportation in order to reduce the weight of structures. Those materials are, despite everything, difficult to recycle and energy consuming to produce. Replacing synthetic fibers by natural fibers is the first step in order to produce bio-based composites [1-2]. Nonetheless, this substitution is not easy and various scientific locks obstacles need to be overcome, especially regarding processing temperatures when using natural fibers. The aim of this study is to evaluate the impact of post-curing temperatures on the mechanical properties of a unidirectional natural fiber reinforced composites (NFC) and to identify among its components, which one is mainly damaged.

The studied composite consists of a matrix made of 80wt% of a DGEBA prepolymer (DER 332) hardened by 20wt% of Isophorone diamine (IPDA). It is reinforced by 4 plies of unidirectional flax fabrics (UD 360) leading to a fiber volume fraction of 30% and manufactured by infusion molding under thermo-regulated conditions (23°C, 50%HR). It was cured 24 hours at 80°C, which is under the evaporation temperature of the water contained in the flax fibers [3], in order to achieve a crosslinking rate of 95%. The non-post-cured composite exhibits an incomplete crosslinking and a glass temperature (Tg) of 114°C. In order to achieve a crosslinking rate of 100% (Tg = 160°C), various cycles of post curing were carried out (2 hours at 100°C, 2 hours at 120°C or 2 hours at 150°C).

Static mechanical tests allowed us to determine the ultimate mechanical properties of the composites. Those properties were not improved by the post-curing heat cycle (Figure 1). Indeed, the ultimate tensile strength dropped from 252 MPa for the non-post-cured composite to 136 MPa for a composite post-cured 2 hours at 150°C. We also observed a change in the Young Modulus which increased from 17.9 to 22.2 GPa after post-curing at 150°C.

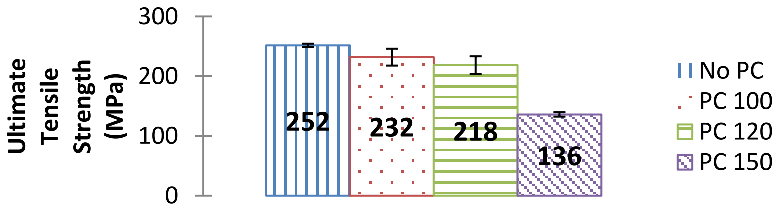

***Figure 1** : Ultimate Tensile Strength of the post-cured composites*

Various mechanical tests were separately conducted on each component of the composite (fabrics or matrix). Those components had undergone (or not) the various post-curing cycles in order to understand the observed changes. Ultimate tensile tests were performed on the resin alone but also on fabrics with a distance between clamps varying from 10 to 200mm leading us to observe different modes of breaking (neat breaking and/or disentanglement of the fibers). The results tended to show that the decrease of the ultimate mechanical properties of the composite coupled with the increase of their rigidity came from the degradation of the fabrics during the post-curing process.

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