Enhancement of the a dhesion between polymer matrix and natural fibers reinforcement in biosourced composites

Essole Padayodi, Rija Nirina Raoelison, Thierry Rouxel, Hugues Baume, Teng Zhang
University of Technology of Belfort-Montbéliard, France

The fiber/matrix interfacial adhesion is one of the major weaknesses limiting the properties of biosourced composite materials. The incompatibility between the hydrophilic natural fibers and the hydrophobic polymer matrix weakens the fiber-matrix adhesion. The objective of this study is to improve the compatibility between flax fibers and polyester matrix by a preliminary treatment of cellulosic fibers by Corona discharge. Two types of composites were produced by infusion with a stacking of [0/90] layers oriented in both warp and weft directions: the composite made of a flax fibers reinforced polyester resin (*Vf ~ 61± 2 vol. %*) and the composite made of a glass fibers fabric reinforced polyester resin (*Vf~ 63 ± 2 vol. %*). The flax fibers and the glass fibers were previously dried at 60°C during 24 hours and treated by the Corona discharge by means of a low frequency high voltage generator. The mechanical properties of composites reinforced with treated and untreated flax fibers and glass fibers are compared: the longitudinal elastic modulus EL and the yield stress XT of the flax/polyester composite increase significantly (+20% to +38%) whereas those of glass/polyester composite increase less importantly. FT-IR spectra analysis, topography analysis and SEM analysis revealed a compatibilization effect on treated flax fibers. New C=O and C-H linkages are created and fibers are more impregnated by the resin. Results showed that the Corona discharge treatment of flax fibers in particular leads to C=O and C-H linkage creation that lowers the fabric surface tension and its better impregnation. This improves the adhesion of fiber-matrix interface and thus the mechanical resistance of the composite.

Biography

Padayodi Essolé is Associate Professor at University of Technology of Belfort-Montbéliard (UTBM, France) and has his expertise in biosourced materials and passion in sustainable design. He is a header of the “Eco-materials” platform in the pole Ercos of Elliadd (EA. 4661, France) laboratory where he led technology research projects for developing sustainable and lightweighting materials for automotive companies.

essole.padayodi@utbm.fr