« Development of novel biodegradable matrix composites »

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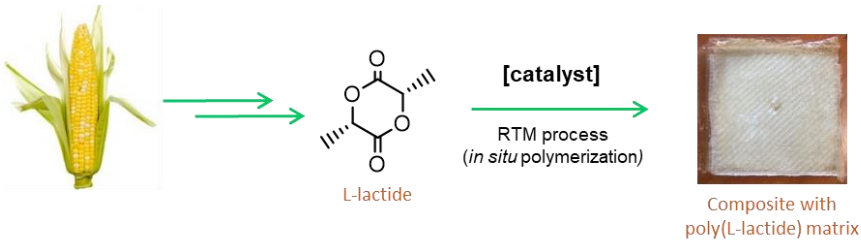
Duration : February - July 2020 ; Salary : 450 euros a month.

Among the different biobased materials available on the market, polylactide (PLA) is becoming more and more competitive and its production is growing. This biodegradable and biocompatible polyester is synthesized either by direct polycondensation of lactic acid, resulting from the fermentation of agroresources, or by Ring Opening Polymerization (ROP) of lactide, a cyclic ester derived from oligomerization-cyclization of lactic acid. ROP polymerization,[1] which leads to the formation of PLA of high molar masses, requires the use of an initiator which initiates the opening of lactide and its polymerization, the most active being tin octanoate which is used industrially. Among commercial lactides, L-lactide (L-LA), resulting from the cyclization of the L-isomer of lactic acid, is particularly interesting since it leads, regardless of the type of polymerization initiator used, to 100 % isotactic polylactide PLLA, semi-crystalline material (T_m = 170 ° C) which displays mechanical properties close to those of polyethylene terephthalate (PET) and whose hydrolytic degradation is slower than that of amorphous polylactides. It has a glass transition temperature (T_g) of about 60 ° C which gives it a high modulus of elasticity (3-4 GPa) and a low elongation at break (2-6%) at room temperature. However, its characteristics, and particularly its low T_g, often make it unsuitable as a substitute for plastics used for everyday-life products.

The objective of this project is to strengthen the PLLA by using it in the form of composites with reinforcements of different kinds. These PLLA matrix composite materials will be produced by RTM (Resin Transfer Molding) process, an innovative process in which polymerization of the polymer matrix is carried out directly in the mold in the presence of the reinforcement. Recent work carried out at UMET laboratory has made it possible to obtain the first prototypes of PLLA / glass fiber composites by this process.[2] The composites obtained during this internship will be characterized by various analysis techniques (SEC, NMR, DSC, TGA, X Ray, tensile tests ...).



The candidate must have knowledge in polymer chemistry and materials chemistry. In order to apply, please send a CV and a letter of motivation to Dr. Fanny Bonnet (fanny.bonnet@univ-lille.fr).

1. O. Dechy-Cabaret, B. Martin-Vaca, D. Bourissou, Chem. Rev., 2004, 104, 6147.

2. E. Louisy, F. Samyn, S. Bourbigot, G. Fontaine, F. Bonnet. Polymers, 2019, 11, 339.