

Subject : Flame retardancy of bio-based plastics

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Abstract:

The worldwide capacity of bio-based plastics will increase from 0.36 Mt in 2007 to 2.33 Mt in 2013 and to 3.45 Mt in 2020. In 2007, the most important products in terms of production volumes were starch plastics (0.15 Mt) and poly(lactic acid) (PLA) (0.15 Mt). The physical and mechanical properties of PLA make it a good candidate as replacement for petrochemical thermoplastics in several application areas. The market is also growing for other bio-based plastics including polyamides (PA11, PA6-10 etc.), polybutylene succinate (PBS), polyether block amide (Pebax) or polyhydroxyalkanoates (PHA). The applications are now focused on durable uses where flame retardancy is an issue. Those polymers as many others are easily flammable and they must be then flame retarded to meet specifications required by the legislation in terms of reaction to fire.

It is the main goal of this internship to develop flame retardant (FR) formulations for those bio-plastics.

The approach to make FR plastics will be the incorporation of additives in the polymer. The Master candidate will use techniques available in the lab including microextruder, mixer, twin-screw extruder and injection-molding to make various formulations. The samples will be then evaluated by specific fire testing (cone calorimetry, UL-94, microcalorimetry and LOI). ***One of the main challenge of this internship will be to select FR additives coming from renewable resources and to get acceptable properties without modifying the others (e.g. mechanical properties).*** The characterization of the samples will be done using appropriate techniques (SEM for the dispersion of the additives in the polymer, DSC for the crystallinity, NMR and FTIR). The mechanism of action will be investigated using novel protocols developed in our laboratory based on rheology, on calorimetry and on measurement of the thermophysical properties of the materials. Therefore many

It is expected for the student to get a multidisciplinary training in a growing area of material science and formulation on an exciting applied topic.