

MATERIALS SCIENCE AND TECHNOLOGY

Ateneo - Advanced methodologies for assessing the degradation and recycling of plastic materials

Funded By	Politecnico di TORINO [P.iva/CF:00518460019]
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Context of the research activity	<p>The research aims to evaluate the degradation of waste plastics under different scenarios (seawater, soil, simulated solar radiation, thermomechanical procedures) using different physico-chemical methodologies.</p> <p>The strengths and weaknesses of the different methodologies will be compared using polymers of different origins in order to scientifically outline the best approaches for targeted and useful characterization of the same materials for their subsequent reuse.</p>
Objectives	<p>The main aim of the research program is the development of a scientific characterization methodology useful for a fruitful reuse of plastic material after different degradation pathways.</p> <p>In particular, the objectives of the research program can be summarized as follow:</p> <ul style="list-style-type: none"> - Accelerated aging of virgin polymers by UV light and/or heat treatments (including in the presence of moisture) to verify on model systems the application of different characterization techniques. - Collection of different post-consumer plastics from different environments (agricultural soils, packaging, automotive, etc.). - Analysis of the collected materials using a multivariate approach for evaluating: chemical composition of both polymers and degradation products (through XRF, FTIR-ATR, Raman, TGA-IR and Pyr-GC-MS), thermal properties and crystallinity (by means of DSC, XRD and TGA), and microstructure and processability (rheological analysis). - Analysis of the type of degradation undergone by different materials and research of the best strategy for recycling, also considering the use of additives, fillers, blends with virgin polymers with a focus on processing capabilities through compounding, extrusion, injection molding. - For all the designed materials, the optimization of the formulations will be carried out through the assessment of the structure-processing relationships. - Production of items with different processing technologies and evaluation of mechanical and functional properties of recycled materials with assessment of microstructure and morphology.

Skills and competencies for the development of the activity

The applicants:

- should have a material engineering and polymeric material background and high motivation to learn through advanced research;
- should demonstrate a research experience in the processing and characterization of polymeric materials;
- should have a background in the specific characterization method on degraded polymers from different environments (soils, marine water, ecc.)
- practical attitude for the lab activities and problem-solving skills are also appreciated.