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PEF (polyethylene 2,5-furandicarboxylate): A new emerging biobased polyester from carbohydrates

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Poly(ethylene 2,5-furandicarboxylate) (PEF) is nowadays considered as a promising sustainable successor of poly(ethylene terephthalate) (PET) for several reasons. First, the PEF is fully biobased since it comes from the polycondensation of bio-based ethylene glycol and 2,5-furandicarboxylic acid (FDCA) which is the chemical analogue of the terephthalic acid. FDCA is currently a.o. produced at pilot plant scale by a C_6 sugars conversion process of vegetable biomass by Avantium. PEF possesses superior barrier properties and more attractive thermal properties (e.g., higher glass transition temperature and lower melting point) than PET. The much lower CO_2, O_2 and H_2O permeability of PEF is a tremendous advantage for packaging applications. In order to fill the requirements of industrial applications, a deep knowledge of polymer structure-property relations is needed and will be the subject of this presentation. An important aspect for both the production and application of aromatic polyesters such as PEF is their crystallization behavior. Drying and solid state polymerization processes, that are common for polyesters, occur above T_g and require the material to be semi-crystalline to avoid massive agglomeration or sticking. This is initially achieved by quiescent crystallization of the polyester. PEF crystals either formed from the glass or from the melt show similar structures but the dynamic of crystal growth differs between the two crystallization pathways. Moreover, annealing at temperatures close to the PEF melting point allowed obtaining information on PEF self-nucleation behavior.

Biography

Nathanael Guigo received his PhD in 2008 from the University of Nice Sophia Antipolis, France in the field of Furanic Based Polymers. He joined the Centre de Recherche sur les Macromolécules Végétales, Grenoble, France as a Post-doctoral Fellow to work on cellulosic fibers in high performance composites. In 2010, he became Associate Professor and in 2013, he obtained a secondment to Avantium (Amsterdam) to work on the poly(ethylene 2,5-furandicarboxylate). His scientific work has been published in more than 25 papers and he has been actively involved in three EU projects relative to the valorization of biomass into new materials.

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