

### Sustainable process for the synthesis of highly crystalline polyimides

A new, environmentally friendly process for synthesizing highly crystalline polyimides has been developed. The underlying technique, hydrothermal polymerization (HTP), is inspired by natural mineral formation processes – in analogy to minerals, high crystallinity can be generated in polyimides. HTP only requires the monomers and high-temperature water, neither organic catalysts nor toxic solvents are necessary. Polyimides generated via HTP are highly crystalline, thus showing superior thermal and chemical stability to their less crystalline analogs.

#### BACKGROUND

Polyimides (PIs) are high-performance polymers showing high thermal stability, combined with other characteristics, e.g. low dielectric constants (i.e. electrically insulating), excellent mechanical properties, good chemical and radiation resistance. Therefore, PIs find broad applications in the electronics and aeronautics sectors. Unfortunately, until now the outstanding properties of PIs came at the high cost of a toxic and environmentally detrimental production process.



#### TECHNOLOGY

Our newly developed method to synthesize polyimides, hydrothermal polymerization (HTP), is inspired by a geological mineral formation process. In contrast to conventional production processes for PIs, HTP does not require any toxic solvents or catalysts, but uses solely high-temperature water and the desired monomers. In addition, HTP generates outstandingly crystalline PIs. Molecular geometry influences various characteristics of a substance, including thermal and chemical stability. High crystallinity increases the thermal and chemical stability beyond molecular geometry's limits. HTP yields products with higher crystallinity and performance than one can obtain by conventional syntheses.

#### BENEFITS

- Environmentally sound production process
- No toxic solvents or catalysts required
- Outstandingly crystalline polyimides
- Applicable to a wide range of monomers
- Morphological tuning through additives technically feasible

#### REFERENCE

M005/2015

#### APPLICATION

Insulating material for electronics /  
Automotive sector /  
Plant engineering /  
Aeronautics / Sports equipment

#### KEYWORDS

high-performance polymers | polyimides | crystalline polymers | hydrothermal polymerization | green synthesis

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