

SUSTAINABLE FIBER-FORMING FLAME RETARDANT POLYAMIDE 6



Scientists from the National Institute of Chemistry and the Faculty of Natural Sciences and Engineering at the University of Ljubljana (NTF-UL) are developing functionalized ϵ -caprolactam ring with phosphorus flame retardant group, fibre-forming flame retardant polyamide 6 with covalently attached flame retardant side functionality, as well as the textile filaments. This represents a scientific and technological breakthrough in the development of advanced flame retardant polymers and melt-spun textile fibres. The main restraint to the end-use of textile products based on PA6 is their flammability. However, halogen-free flame retardant PA6 textile filaments are still not commercially available. Successful production of flame retardant textile filaments is influenced by the type and concentration of incorporated flame retardant, which if added in higher amounts

prevents continuous melt-spinning process. The special design of a new polyamide 6 linear polymer with covalently attached phosphorus based functionality enables continuous melt-spinning and production of PA6 fibres with highly efficient flame retardancy and self-extinguishing properties.

TYPE OF COOPERATION

R&D cooperation and technology
licensing opportunity

INTELLECTUAL PROPERTY

WO 2020002403 [A1]
EP3587471 [A1]

DEVELOPED BY

Department of Material Chemistry
Chair of Textile and Clothing
Engineering, NTF-UL

CONTACT

Knowledge Transfer Office
P: 00386 1 4760 529
E: knowledge.transfer@ki.si

MORE INFORMATION ABOUT THE INVENTION



Technology

The invention relates to the functionalization of ϵ -caprolactam (CLM) ring with phosphorus flame retardant group (FR) to produce FR-CLM and co-polymerization of CLM with FR-CLM to produce fiber-forming polyamide 6 (PA6) with FR group bonded as the side group and production of the flame retardant self-extinguishing textile filaments by the melt-spinning process. This approach enables preservation of the PA6 backbone, while the covalently attached FR side group prevents migration and leaching of the flame retardant from the product. The fiber-forming characteristics are suitable for the preparation of woven as well as non-woven textiles, and this flame retardant PA6 could also be used for the production of flame retardant plastics. The invention solves the problem of high flammability of PA6 textile materials and fire accidents that could be caused as well as the problem of migration and leaching the flame retardant from the polymer, as high concentrations of flame retardants detected in air, water and soil are highly dangers for the eco-system.

Main advantages

- Sustainable as the starting material can be obtained by biomass recycling
- Low effective concentration of flame retardant (10% for FR-PA6 engineering plastic and 15% for FR-PA6 textile filaments)
- Incorporation of flame retardants during polymerisation process enables easy implementation of the invention and savings in time and energy.
- Chemically recyclable (back to the monomer)

Key words

Flame retardancy, sustainability, polyamide 6, plastics, melt-spinning