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Novel fibre forming flame retardant polyamide 6

Wide application of polymers and derived products is causing additional demands in their safe usage, especially in the field of fire safety. Polyamide 6 (PA6) represents one of the most competent high-performance industrial polymers for the technical textile production. The main restrain to the end-use of textile products based on PA6 is their flammability. The strict regulation rules exclude bio-persistent and toxic halogenated flame retardants from the use and require application, of more environment-friendly and sustainable flame retardants. As a consequence, halogen-free flame retardant polyamide 6, FR-PA6 textile filaments are still not commercially available.

In our research, we presented a new approach for solving PA6 flammability in which flame retardant organophosphorus functionality is introduced into the polymer structure within copolymerisation process 1, 2. The first step in the preparation of flame retardant PA6 co-polymer was the synthesis of co-monomer based on 9,10-dihydro-9-oxa-phosphaphenanthrene-10-oxide, DOPO functionalized3 caprolactam. In the next step, the introduction of 15 wt% of synthesised co-monomer in the copolymerisation reaction with -caprolactam resulted in obtaining of co-polymer that exhibited V0 flame retardancy level according to UL94 vertical burning test. Co-polymer with 10 wt% of co-monomer was used for successful textile filament production in the melt-spinning process.

The new approach for FR-PA6 textile filaments production, where more environment-friendly and more sustainable flame retardant functionality is included into PA6 polymer structure by the copolymerisation reaction, was mentioned to be a solution for the flame retardant agglomeration and leaching problems present in the case when flame retardant additives are physically incorporated by melt-compounding. The advantage of the copolymerisation process is also the preservation of PA6 chain structure, which provides chemical FR-PA6 recycling. Furthermore, the possibility for obtaining co-polymer starting material from biomass recycling enables establishment of a circular economy.

Biography

Marija Colovic has completed her PhD at the Faculty of Chemistry and Chemical Technology in Ljubljana in 2012 at the National Institute of Chemistry, Department of Materials Chemistry, Ljubljana, Slovenia. She continued her research at the synthetic resin industry as head of the R&D analytical department. She has 11 publications that have been cited over 100 times. She is an author on the two European patent applications.

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