Phoshor-containing flame retardants on textiles: investigation of the structure-dependent mode of action in basic experiments

A fire can easily start: For example, the flame from an ignition source, like a defective power strip, spreads to surrounding easily combustible materials. These can be highly flammable textiles such as curtains or upholstered furniture. To minimise the risk of fire, the flammable materials are normally provided with flame retardants that prevent or at least delay flashover and spread of the fire. However, many of the currently used flame retardants are hazardous to health and the environment. Therefore, textile finishing manufacturers and suppliers are moving towards alternatives that meet government regulations and laws regarding human security, environmental impact as well as sustainability. For the development and designing of new environmentally compatible and effective flame retardants, however, determining the activity of flame retardants for a specific flame retardant system such as textile finishing is essential. Understanding of the mode of action of flame retardants is still incomplete due to the complexity of combustion process, where flow and mixing processes interact with complex chemistry and energy transfer in both the gaseous phase and the condensed phase. This can be attributed, among other things, to the lack of simplified experiments that would allow separation and individual investigation of the different steps.

Therefore, in the course of the DFG project "Phosphorus-containing flame retardants for textiles: investigation of the chemical functionality-dependent mode of action in basic experiments", such an approach is being set up with a simplified test rig in Duisburg and used to identify and monitor the decomposition pathways of known flame retardants and the new ones to be synthesised. The experiment should enable a time-independent (stationary) investigation. The expertise available at the Chair of Thermodynamics at the UDE (Prof. Atakan) in the field of gas phase analysis will be used and combined with the competences of the project partner Dr. Thomas Mayer-Gall (German Textile Research Centre Krefeld) in the production and application of new flame retardants on textiles, their investigation to validate the condensed phase activity of flame retardants as well as with standardized methods of flame tests. Through the joint work, more research is to be done on the fundamental mode of action of PIN flame retardants (phosphorus, inorganic and nitrogen flame retardants) in both phases, in order to be able to specifically design and produce effective and environmentally friendly flame retardants.

Angaben zum Forschungsvorhaben:

Förderkennzeichen: DFG 517869745

Laufzeit: 01.08.2023 – 31.01.2026

Projektpartner: Deutsches Textilforschungszentrum Nord-West gGmbH, Krefeld

Universität Duisburg-Essen, Lehrstuhl für Thermodynamik,

Kontakt: Dr. Thomas Mayer-Gall, Tel.: +49-2151-843-2015, E-Mail: mayer-gall@dtnw.de