



Pursuing the challenge of developing bio-based isocyanate free polyurethane textile coatings

David De Smet | dds@centexbel.be

"Bio NIPU", an Interreg Flanders-Netherlands project, focuses on the development of 100% bio-based and isocyanate-free polyurethane (bio NIPU) for end products in the textile and synthetic rubber industry. The production of biopolymers for commercial applications is increasing year after year. However, biopolymers for textile coatings and synthetic rubber (elastomers), such as polyurethane, are only available for a limited number of applications and are not fully bio-based. Polyols and isocyanates are used for the synthesis of polyurethane. EC adopted a regulation amending Annex XVII of REACH to restrict diisocyanates on the EU market. The Bio NIPU project therefore focuses on research into alternative building blocks for the synthesis of polyurethane avoiding the use of isocyanates. Renewable raw materials are used to develop bio NIPU with a bio-based content of at least 80%. The project consortium consists of Centexbel, Limburgse Urethaan Chemie, Maastricht University, Stahl and Thomas More.

In the BioNIPU project, NIPU dispersions and NIPU acrylates for coatings and NIPU elastomers were developed. The bio-based content of the NIPU dispersion was higher than 95%. Since the glass transition temperature of the NIPU was about -60°C , it was evaluated as an adhesive layer. The NIPU coating showed good light fastness and hydrolysis resistance. Polyester fabric coated with a NIPU adhesive layer and a PU topcoat showed good resistance to hydrostatic pressure initially and after 10 wash cycles at 40°C (Fig. 1).

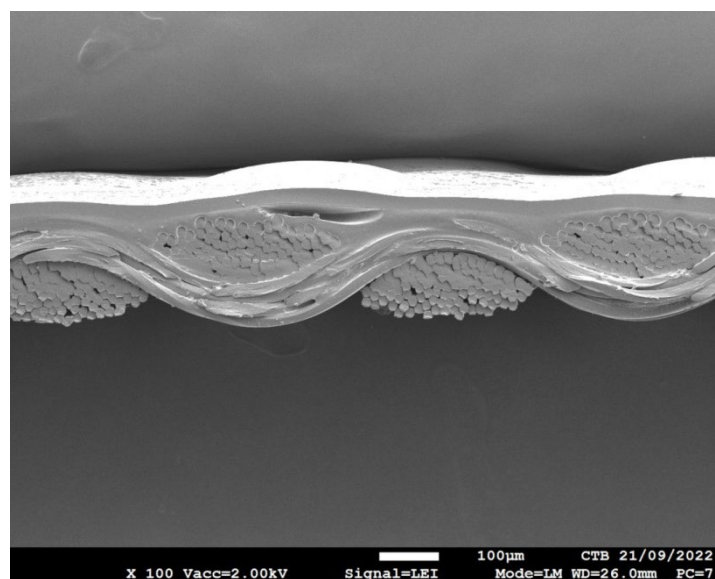


Fig. 1: SEM picture of cross-section of polyester coated with NIPU base coat and PU topcoat

NIPU acrylates were synthesized via the reaction between amine-terminated NIPU prepolymer and diacrylates. The resulting coating showed good resistance to solvents such as MEK and had a pencil hardness HB.

In the BioNIPU project, two approaches were developed to produce NIPU/NIPUrea elastomers. In the first approach, hydroxy terminated prepolymers were first synthesized. Subsequently chain extender and crosslinker were added to cure the polymer. In the second approach, amine terminated prepolymers were obtained, which was followed by curing with chain extender and crosslinker.

Both of the prepolymers prepared from these two approaches exhibited tuneable molecular weight between 1500 g/mol and 20000 g/mol, tuneable viscosity, tuneable melting points between 50 °C and 100 °C, tuneable glass transition temperature between -40 °C and 15 °C and aromatic linear molecules. By wisely choosing suitable chain extenders and crosslinkers, after curing, the elastomers showed good mechanical properties and high stability.

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