



1 *Assembly of the foam qualification system (Foamat Messtechnik).*

2 *Biodegradable PU foam.*

Fraunhofer Institute for Chemical Technology ICT

Joseph-von-Fraunhofer-Strasse 7
76327 Pfinztal
Germany

Contact

Ronny Hanich
Phone +49 721 4640-586
ronny.hanich@ict.fraunhofer.de

Dr. Davide Pico
Phone +49 721 4640-867
davide.pico@ict.fraunhofer.de

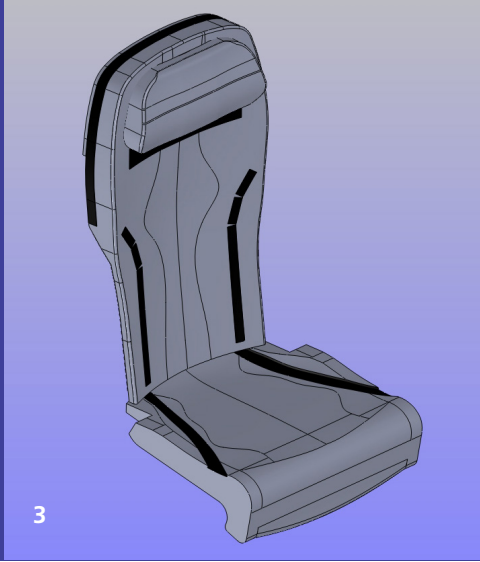
www.ict.fraunhofer.de

POLYURETHANE FOAM FROM RENEWABLE RESOURCES

Polyurethane (PUR) is a widely-used polymer, which has a unique potential due to the different material properties it offers. These properties can be tailored to meet the requirements of numerous applications, such as flexible foam for upholstery, semi-rigid integral skin foam for automotive parts, rigid foam for insulation, thermoplastic elastomers and coatings.

One of the key applications is flexible foam for different kinds of cushions. A standard seat in an airplane uses flexible PUR foam for the seating cushion and the backrest. Within the lifetime of an airplane the cushions need to be replaced several times, which makes them one of the most significant waste products from passenger airplanes over time. The introduction of raw materials from renewable resources would therefore reduce the carbon footprint of the seating cushions.

Furthermore, one of the biggest disadvantages of this material is its high ignitability. Unprotected PU foam can be ignited by heat sources such as lighters or cigarettes. For this reason flame retardants are used to minimize this risk and to ensure that the material passes the stringent aviation regulations concerning ignition and burning. Nevertheless, the use of flame retardants is always a double-edged sword. The protection against fire comes with a negative impact on the mechanical properties of the PUR foam, with health risks (especially where halogenated non-polymeric flame retardants are used), and with a higher complexity in the recycling process.



Formulation of polyurethane foams

The chemistry of polyurethanes is quite complex and mainly influenced by the raw materials polyol and isocyanate, but also by additives like catalysts, surfactants and flame retardants. Depending on the product's properties, suitable ingredients must be chosen and formulated.

After a process of careful selection and adjustment, the profiles required in terms of reaction, foaming, viscosity and foam properties can be obtained.

The innovation

It was possible to develop a formulation for flexible PUR foam which passes the FAR 25.853 appendix F fire regulation test without the use of any additional flame retardant. The formulation consists of about 22 wt% renewable material. This decreases the carbon footprint of the foam and facilitates its recycling via glycolysis.

3 CAD design of seating cushions

4 Demonstrator with the new green polyurethane seating cushion.