GECKO-INSPIRED DRY ADHESIVES FABRICATED BY ROLL-TO-ROLL PROCESS WITH MODULATED UV-CURABLE POLYMERS

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The mechanism of gecko adhesion has attracted much attention due to its reliable and reversible attachment to many materials. To mimic the fibrillar structures of gecko feet, dry adhesives have been previously developed by micro-patterning of elastomeric materials such as PDMS. At INM, the science base of the adhesion mechanisms has been established over the last decade. More recently, a technology base was established (Gecomer® Technology) and numerous prototypes were developed to demonstrate its potential in diverse fields of technology.

Currently, INM is taking the lead in advancing the fabrication technology from laboratory methods to larger areas. The aim is to achieve a continuous and scalable fabrication of micropatterned dry adhesives. In this study, a UV-curable resin was developed under consideration of both the performance in the target application as a reversible gripping adhesive and its suitability for a roll-to-roll fabrication process. A multi-component resin based on poly (urethane acrylate) was used and tuned by the amount of cross-linker, reactive thinner, photo-initiator and other additives over a wide range. In this way, the thermal property, viscoelasticity, surface chemistry and adhesion performance can be controlled.

By integrating a roll-to-roll pilot line equipped with an embossing unit, the microstructured dry adhesive can be fabricated in the form of thin layer on PET foil in a scalable and continuous manner. The results demonstrate the feasibility of an economical route to large-area micropatterned dry adhesives for diverse applications.