TOWARDS THE DEVELOPMENT OF SMART TEXTILE UV-SENSORS USING INKJET PRINTING AND UV-LED CURING

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ABSTRACT

Research on smart textiles has been ongoing for many years, however only few smart textile products are available on the market. One reason to why smart textiles have not experienced the desired commercial success is that conventional production processes lack process flexibility and resource efficiency. For smart and functional products, which necessitate high-cost materials and require small batches, resource-efficient processes can boost their breakthrough. This paper focuses on the resource-efficient production of UV-sensing smart textiles based on photochromic dyes, which are printed by inkjet printing and cured by UV-LED light. Photochromic dyes dispose of a reversible color change initiated by photoelectric excitation [1]. This property makes the dyes suitable materials for smart textile sensor applications to alarm the user of the presence of harmful UV-rays with an indication of a colour [2]. With the aim to develop smart textile UV-sensors, the properties of two different types of commercial photochromic dyes – a naphthopyran and a spirooxazine – are investigated. This paper presents an overview of the required steps, which are necessary in the development of a UV-sensing textile, where ink jettability and the prints' colour performance, durability and textile character are essential. The photochromic materials are analyzed through rheology and surface tension measurements, colour measurement, scanning electron microscopy and Kawabata evaluation system. Our work connects to other studies, where the kinetics of photochromic dyes are altered as a result of free volume and matrix rigidity surrounding the dye molecules [3-6]. This study focuses on how the photochromic performance can be tuned using fabrication parameters during printing and curing in a continuous production process. By changing fabrication parameters such as the amount of ink deposition, transportation belt speed and lamp intensity, the matrix rigidity of the UV-ink, which carries the photochromic dye, can be modified. A substantial finding as a result is that fabrication parameters influence dye kinetics, print durability as in abrasion and washing and the textile character and hence help to tune the performance of textile UV-sensors.

References

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