HOT LITHOGRAPHY: THE BRIGHT FUTURE OF CATIONIC PHOTOPOLYMERZATION

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UV curing of photopolymerizable formulations has been used for more than a half century for protective and decorative coatings of paper, wood, metals or plastics. Advantages can for sure been found in the high curing speed that allows the conversion of typically (meth)acrylate-based monomers within the fraction of a second. Furthermore, a large variety of monomers is commercially available so that the mechanical properties and other polymer characteristics can be easily tuned.

In the last decade, there has been a strong demand for the curing of thicker layers or even to print arbitrarily shaped 3D cellular structures out of these materials. For the latter one, additive manufacturing technology (AMT), also called 3D printing or Rapid Prototyping, is the method of choice [1]. Different setups are commercially available that allow the printing of photopolymerizable formulations from a simple CAD model. Laser or DLP (Digital light processing) based systems fabricate polymer parts with a feature resolution of about 10 µm. One of the major issues is that only tightly cross-linked networks are formed [2]. These materials suffer also from an inhomogeneous polymer architecture and therefore brittle behavior. To circumvent those problems, the Hot Lithography process has been developed by Cubicure that allows processing of high molecular weight resins, leading to much tougher materials.

In contrast to radical polymerization, the kinetics of the cationic type mechanism is strongly temperature dependent. Therefore, the Hot Lithography process opens the window for entirely new classes of monomers in the field of photopolymerization. Up to now, there were no processes available for cationic photopolymerization that are used at up to 120°C. With this process, we were able to show that polyoxazolines [1], polyesters, polycarbonates or phenolic resins can be directly printed with this technique.

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