Reactive direct bonding of Digital Light Process components

Elmar Moritzer[1], Christine Driediger[1, 2*]

[1] *Paderborn University, Kunststofftechnik Paderborn (KTP), Pohlweg 47-49, 33098 Paderborn, Germany*

[2] *Paderborn University, Direct Manufacturing Research Center (DMRC), Mersinweg 3, 33100 Paderborn, Germany*

Keywords. Digital Light Processing; Vat Photopolymerization; reactive direct bonding; material combination

Abstract.
A major restriction in additive manufacturing is the limited volume of the printers. In the Digital Light Process (DLP), the build chamber sizes of the available printers are particularly small compared to other processes. If components with larger dimensions are to be manufactured additively, the STL file is often split up into smaller files and manufactured in several jobs and joined afterwards. A frequently used joining process is adhesive bonding. High strength and durability of bonded joints can be achieved with chemically curing adhesives. In chemically cured adhesives, monomers or oligomers are present which react as a function of time, temperature and pressure to form a polymeric adhesive layer. One-component systems do not react without activation. Triggers for the reaction can be water, the absence of oxygen, radiation (e.g. UV radiation) or heat. In the DLP, the component is also built up via a chemical reaction. This is triggered layer by layer by UV radiation and is comparable to the reaction of a UV-curing adhesive. Directly after manufacturing the DLP components are not fully cured. This can be used for a reactive direct bonding of the DLP components without any adhesives. In this study, a procedure is developed for reactive direct bonding and the strength of the bonding joint is investigated. Resins based on different polymers are considered and also a suitability for material combinations is investigated. The results of this study show that reactive direct bonding of DLP components is possible and that strengths similar to the component material can be achieved.