Final Report

Project acronym: *SYMPA*

Project number*: 5036*

M-ERA.NET Call 2017

Period covered: 01/08/2018 to 31/07/2021

Coordinator: Prof. Dr. Peter Middendorf | peter.middendorf@ifb.uni-stuttgart.de
University of Stuttgart | Germany

2. Publishable project summary

The SYMPA project aimed to develop new materials, processes and post-treatment methods for stereolithography processes in order to enable long-term use for automotive applications.

In contrast to other additive manufacturing processes, such as fused filament fabrication or selective laser sintering, stereolithography can be used to produce components from a liquid photopolymer with very high precision, excellent surface quality, additionally functionalized surface textures and with almost completely reusable raw material.

However, prior to the start of the project, photopolymers were usually processed without fillers or special coatings. As a result, the mechanical properties and environmental resistance were limited due to the restricted covalent bonding forces between the carbon molecules within the photopolymer. The application of stereolithographic produced components was therefore mostly only in the area of unstressed illustrative prototypes. There was therefore a need for a new class of materials and coating systems to enhance the material properties.

The project consortium, built up via M-ERA.NET II from 3 small and medium-sized enterprises, 1 large enterprise and 2 research institutions, developed new materials, production equipment and post-processes for the improvement of the mechanical and environmental stability of stereolithographic produced components.

For this purpose, the focus was put on increasing the mechanical properties through the use of reinforcing short fibres. On the one hand, it was possible to develop technologies for the direct introduction of fibres during the production of the layer in the printing process (in-situ), and thus a subsequent reinforcement in a further production step. In this way, the stiffness and strength could be increased in comparison to pure photopolymers and a fast processing could be achieved by modifying the printing process.

In addition, the protection of the printed components against environmental influences was investigated focusing towards increasing UV stability and reducing wear. Acrylic lacquers, MoS2, WS2 and ZnO metal particles in combination with a plasma coating system and optimized deposition conditions enabled the successful realization of protective coatings.

The industrial applicability of the developed technologies was successfully shown by several demonstrators like a topology optimized UAV engine mount with in situ short-fiber reinforcement, scratch and wear resistant coating on car key covers, a door handle with subsequent carbon fiber reinforcement, conductive selective coatings and transparent light guides with UV protective coatings.