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Direct manufacturing of μm structured surfaces by vat potopolymerization method

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Abstract

Nature has developed desired functional surfaces on a different scale from macro to molecular scale. For instance, micro-fluidics, a lotus-like characteristic and water repellence surfaces with self-cleaning properties structures are requested for different applications. Various manufacturing methods were applied for fabrication of micro surfaces such as Lithographie, Galvanoformung, Abformung (LIGA), Photolithography and soft lithography and dip-transfer method that consists of several process steps for final part production. Additive manufacturing (AM), unlike previous methods is possible for direct fabrication of complex microscale features by decreasing the manufacturing time and reducing production cost. This study evaluates the direct fabrication of micro features by AM process. The part was designed in a hierarchical structure with the neck diameter of 400 µm and a 20° draft angle surface, on the top the array of pillars were placed with the diameter from 90 µm down to 60 µm. Vat photopolymerization method was used with a specifically designed AM machine tool proper for precision micro dimensional scale manufacturing. In this method, the printing parameters were tuned based on the previous studies in order to improve the fabrication quality of the process.

(a) (b)

Figure 1: the printed features inspired from nature.