DESIGN FOR DISASSEMBLY – USING A MULTI MATERIAL APPROACH IN 3D PRINTING FOR EASIER RECYCLING STRATEGIES

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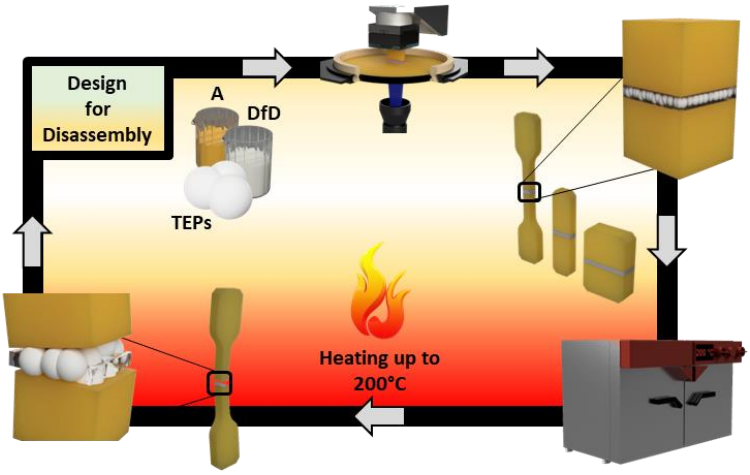

Figure 1: *Concept of Design for Disassembly (DfD)*

Due to advancing technology, a wide range of electrical devices, including consumer electronics, and batteries, are being rapidly developed and increasingly used in daily life. These components contain crucial resources, including noble metals and rare earth elements, that must be reclaimed for future use. Yet, achieving a higher device performance necessitates a complex and highly integrated architecture to increase efficiency. This makes it more difficult to recycle such systems and to regain the valuable materials. Additive manufacturing, commonly known as 3D printing, has the potential to address this issue due to its distinct capabilities to produce parts within the micron range, the freedom of geometrical design, and the ability to process thermoset polymers. [1]

Herein we present a first step to use additive manufacturing to create better recyclable components. By introducing the concept of "Design for Disassembly" (DfD) we aim to highlight the potential for products, or multi-material components to be separated and recycled with ease. Using a multi-material approach, we printed a thin layer of a Disassembly material (DfD-material) within two blocks composed of Material A (Figure 1). The DfD-material should not affect the (thermo)mechanical properties of the component. However, upon activation with a thermal impulse, it should facilitate the separation of the component. Additionally, Thermally Expandable Particles (TEPs) were incorporated into the DfD-material to enhance separation.

To assess the influence of the DfD-material, various specimen groups (including those with and without the DfD-material) were printed and analysed for their (thermo)mechanical properties, and the ability to be disassembled.

References

1. Ligon, S. C.; Liska, R.; Stampfl, J.; Gurr, M.; Mulhaupt, R., Polymers for 3D Printing and Customized Additive Manufacturing. Chem Rev 2017, 117 (15), 10212-10290.