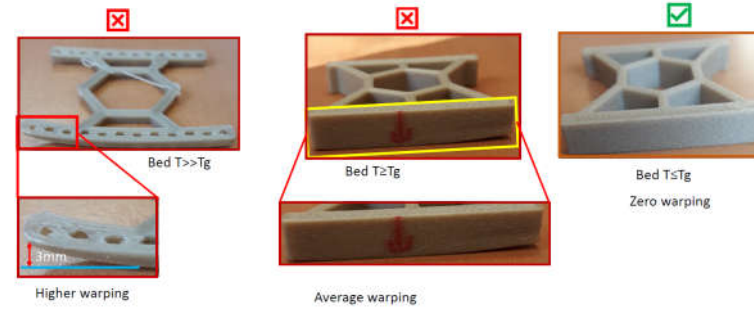# Development of a digital twin of 4D printing process of intelligent biomaterials

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The goal of this Ph.D. thesis is to explore the functionalities and opportunities of 4D printed smart materials while minimizing their fabrication challenges. The foundation of 4D printing depends on four mainstream blocks, including smart materials, 3D printing techniques, external stimuli, design, and modeling, respectively. Therefore, a digital twin of combining the FDM printing technique with smart materials and their numerical simulation would accelerate the 4D printing process.