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Microfluidic experiment and simulation technique for the measurement and representation of particle deformation during three-dimensional bioprinting JIA MIN LEE, WIN TUN HAN, JUHA SONG, WAI LEE CHAN, Nanyang Technological University, Singapore — Recent advances in biofabrication allow for the production of organs constructs in vitro, which can mimic the microenvironments of native tissues. One of the most promising biofabrication methods is the extrusion-based bioprinting, which utilizes additive-manufacturing concepts to deposit bioinks laden with living cells. However, the survivability of the cells was found to be reduced by the extrusion process. To enhance their survival rate, the cells can be enclosed in protective particles. Still, the particles protection may be rendered ineffective by high flow shear-stress, which is challenging to measure. Therefore, a microfluidic experiment that can represent the bioprinting setup was developed. As the bioink was pushed through the microfluidic chip at flow-rates equivalent to the bioprinting, the particle deformations were captured using a microscope, from which stresses can be derived. To this end, several experiments at different conditions have been completed, demonstrating the feasibility of the measurement procedures. Image-processing techniques are being developed to systematically analyze the particle deformations. In addition, smoothed particles hydrodynamics is used to simulate the experiment to explore its applicability in describing the problem.

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