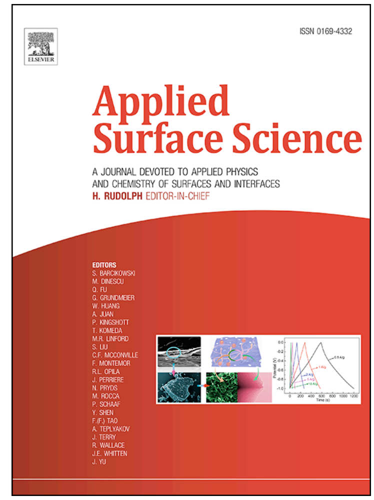

Full Length Article

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Jetting dynamics of Newtonian and non-Newtonian fluids via Laser-induced forward transfer: Experimental and simulation studies

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Abstract

Current technological trends in the field of microelectronics have highlighted the requirement to use cost-effective techniques for the precise deposition of highly resolved features. Laser-induced forward transfer (LIFT) meets these requirements and has already been applied for the direct printing of devices and components. However, in order to improve the process' reproducibility and printing resolution, further research has to be conducted, regarding the rheological characteristics of the printable fluids and their jetting dynamics. In this work, we employ both pump-probe and high-speed imaging in order to investigate the formation and expansion of the liquid bubble, as well as the liquid jet's propagation. Newtonian as well as non-Newtonian fluids are studied and compared, over a wide range of viscosities. Furthermore, a computational model is utilized in order to gain more insight on the transfer mechanisms of the process. The simulation predictions are validated against experimental results, and found to be in good agreement, even in the case of non-Newtonian fluids. The results indicate that such accurate modelling can be developed as a new cost- and time-effective tool for the technique's optimization.

Keywords: Laser– induced forward transfer, nanoparticle inks, Newtonian fluids, non-Newtonian fluids, jetting, simulation.

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