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Modeling of droplet coalescence on non-uniform surfaces with the lattice Boltzmann method KRZYSZTOF KUBIAK, University of Leeds, M.C.T. WILSON, J.L. SUMMERS, N. KAPUR, K. HOOD — Droplet coalescence is a key feature in a wide range of processes, e.g. spray coating, emulsion polymerization, inkjet printing, sintering etc. Significant progress has been achieved in experimental work on dynamic droplet coalescence, however proper and physically meaningful modeling is still a challenge. Most existing models are unable to capture the waves created on the free surfaces of droplets in the early stage of coalescence and/or dynamic oscillations of the neck between two droplets. This paper investigates droplet coalescence using a multiphase lattice Boltzmann method with a flexible wetting model. The well known Shan-Chen interparticle potential method, has been found to capture properly dynamic of sessile droplets coalescence. Oscillations of the neck present good agreement with experimental data. LBM simulations in 3D allow a comparison of the final footprint of droplet. Introduction of a non-uniform surface wettability into the model, in the form of hydrophilic patterns, helps to obtain final footprints of ellipsoidal form. Different size and distribution of patterns has been studied to analyze its influence on the coalescence process. The lattice Boltzmann method presents great potential for coalescence modelling especially on non-uniform surfaces. The dynamics of droplet coalescence can be properly simulated and the final footprint can be predicted.

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