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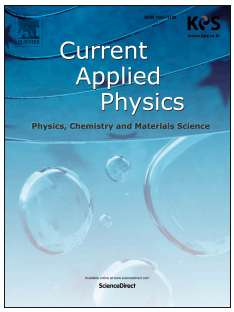

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Short time dynamics of water coalescence on a flat water pool

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Abstract

Coalescence is an important hydrodynamic event that frequently takes place in nature as well as in industry. Here we provide an experimental study on short time dynamics of water coalescence, particularly when a water droplet comes in contact with a flat water surface, by utilizing high-resolution high-penetration ultrafast X-ray microscopy. Our results demonstrate a possibility that an extreme curvature difference between a drop and a flat surface can significantly modify the hydrodynamics of water coalescence, which is unexpected in the existing theory. We suggest a plausible explanation for why coalescence can be modified by an extreme curvature difference.

Keywords: Water, Coalescence, X-ray imaging, Hydrodynamics

1. Introduction

Coalescence between drops usually takes place to minimize the surface energy. Symmetric coalescence between equal-sized drops [1, 2, 3, 4] has been extensively studied because of its simplicity and importance in natural and industrial situations. Early-time growth of the liquid bridge that accompanies coalescence driven by Laplace pressure has long been a central topic in fluid dynamics with the aim of understanding the relevant coalescence mechanisms. The liquid-bridge growth has been interpreted theoretically throughout integral description in Stokes flow[1] and experimentally with high-speed optical imaging[2] and electrical methods [3, 4]. However, asymmetric coalescence between different-sized drops[5, 6, 7, 8] has been poorly investigated so far, although it is essential

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