

Abstract Submitted
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Substrate **Wettability** **Affects** **Mixing**
During Droplet Coalescence¹ THOMAS C. SYKES, DAVID HARBOTTLE,
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M. THOMPSON, MARK C. T. WILSON, University of Leeds — Internal jets can
vastly improve mixing efficiency during droplet coalescence. For free droplets, jet
formation depends on geometry, initial configuration and fluid properties. When
at least one of the coalescing droplets is on a substrate, we systematically demon-
strate that the three-phase contact line and substrate wettability are crucial too.
In particular, using both high-speed imaging and quantitatively validated numerical
simulations incorporating the Kistler dynamic contact angle model (with hysteresis)
we investigate internal jet formation during the coalescence of an initially static free
droplet and a sessile droplet of the same fluid. We identify and elucidate a mecha-
nism of jet formation arising for surprisingly low sessile to free droplet volume ratios,
showing that the presence of a substrate can improve mixing efficiency. Moreover,
this mechanism is found to depend on substrate wettability with the importance of
advancing contact angle subordinated to that of receding contact angle. Droplet ge-
ometry and fluid properties are also considered to thoroughly explain the dynamics
observed.

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