Fluid deposition and spreading on topography

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Microdroplet deposition is a technology that spans applications from tissue engineering to microelectronics. Our high-speed imaging measurements reveal how sequential linear deposition of overlapping droplets on flat uniform substrates leads to striking non-uniform morphologies for moderate contact angles. We develop a simple physical model, which for the first time captures the post-impact dynamics drop-by-drop: surface-tension drives liquid redistribution, contact-angle hysteresis underlies initial non-uniformity, while viscous effects cause subsequent periodic variations. Motivated by applications to the manufacture of POLED displays, we turn to the spreading of a single droplet within a recessed stadium-shaped pixel. We find that the sloping side wall of the pixel can either locally enhance or hinder spreading depending on whether the topography gradient ahead of the contact line is positive or negative. Locally enhanced spreading occurs via the formation of thin pointed rivulets along the side walls of the pixel through a mechanism similar to capillary rise in sharp corners. We demonstrate that a thin-film model combined with an experimentally measured spreading law, which relates the speed of the contact line to the contact angle, provides excellent predictions of the evolving liquid morphologies of multiple-droplet deposits on topography.