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Wetting in flatland: Complex interfacial transitions at inhomogeneous solid-gas interfaces PETER YATSYSHIN, MIGUEL A. DURAN-OLIVENCIA, Department of Chemical Engineering, Imperial College London, ANDREW O. PARRY, Department of Mathematics, Imperial College London, CARLOS RASCON, Department of Mathematics, Universidad Carlos III de Madrid, SERAFIM KALLIADASIS, Department of Chemical Engineering, Imperial College London — Interfaces between the different phases of matter surround us, and since the days of van der Waals have been known to provide key insights into the workings of the atomic world. A classical example of this is the adsorption of liquid films at a planar, homogeneous solid-gas interface. It is well-known that substrates with first-order wetting transitions also exhibit a line of first-order prewetting transitions corresponding to the jump from a thin to a thick adsorbed liquid film. We use classical density functional theory to model adsorption on patterned walls and unravel the zoo of associated interfacial phase transitions and its complexity. We show that the thick prewetting film can nucleate at a lower pressure and to continuously spread out across the surface as the prewetting line is approached, thus manifesting “complete prewetting in flatland. We also interrogate a planar wall chemically patterned with a deep stripe of a different material. This introduces interfacial unbending from the stripe into the picture. Surprisingly, for thin stripes, the lines of prewetting and unbending may merge, leading to a new two-dimensional wetting transition occurring along the walls. Our results may have ramifications for the design of lab-on-a-chip devices and controlled nanofluidics.

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