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Contact angle hysteresis at the nanometer scale THIERRY ONDARCUHU, MATHIEU DELMAS, MARC MONTHIOUX, CEMES-CNRS, NANOSCIENCES TEAM — Whereas thermodynamics predicts that the contact angle of a liquid droplet at rest on a solid surface is given by the Young-Dupré equation, experiments on real solid surfaces show that this contact angle is not univocal but exhibits a hysteresis which depends on the droplet history. Despite many theoretical and experimental studies devoted to this problem, a quantitative correlation between contact angle hysteresis and surface defects shape or repartition is still lacking. Here, we study the pinning of a contact line on nanometric defects by measuring, by atomic force microscopy, the capillary force exerted by a liquid on a carbon tip. This original quasi-1D geometry allowed us to study nanometric defects. We observe localized jumps which results from the pinning of the contact line on individual defects. A detailed study of the force curves validates the theory of weak and strong defects, postulated by Joanny & de Gennes (J. Chem. Phys., 81 (1984) 552). In particular, we bring the first experimental evidence of weak defects which do not contribute to hysteresis and study the energy dissipated on strong defects down to values of the order of kT. We then show how individual defects interact to give rise to contact angle hysteresis as measured at macroscopic scale, thus providing a precise description of the origin of contact angle hysteresis at nanometer scale.

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