123f Reversible Self-Propelled Droplet Movement: a New Driving Mechanism

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Reversible self-propelled movements of droplets of long chain alkanes are presented and analyzed. Slightly above the bulk melting temperature, solid alkane multilayers at planar solid/gas interfaces melt into droplets which move in a self-avoiding, random path. While moving, the droplets consume the solid alkane on their path, leaving behind a widening groove. At temperatures slightly below bulk melting this process can be reversed. Now the droplets move backwards leaving behind a solid trail. The (narrowing) trail is nourished by the moving droplets whose volume decreases accordingly. The droplet speeds depend on temperature and thickness of the melting (solidifying) multilayer. Contrary to self-propelled droplets in “reactive wetting” they do not depend on droplet size. The melting enthalpy is identified as energetic source for the droplet movement. With this assumption all experimental data can be unified into one master curve. Independent experimental results from stationary droplets corroborate the suggested scenario.