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Coalescence-induced droplet actuation[1] MATHIEU SELLIER, University of Canterbury, CLAUDE VERDIER, CNRS, VOLKER NOCK, University of Canterbury — This work investigates a little explored driving mechanism to actuate droplets: the surface tension gradient which arises during the coalescence of two droplets of liquid having different compositions and therefore surface tensions. The resulting surface tension gradient gives rise to a Marangoni flow which, if sufficiently large, can displace the droplet. In order to understand, the flow dynamics arising during the coalescence of droplets of different fluids, a model has been developed in the lubrication framework. The numerical results confirm the existence of a self-propulsion window which depends on two dimensionless groups representing competing effects during the coalescence: the surface tension contrast between the droplets which promotes actuation and species diffusion which tends to make the mixture uniform thereby anihilating Marangoni flow and droplet motion. In parallel, experiments have been conducted to confirm this self-propulsion behaviour. The experiment consists in depositing a droplet of distilled water on a "hydrophilic highway." This stripe was obtained by plasma-treating a piece of PDMS shielded in some parts by glass coverslips. This surface functionalization was found to be the most convenient way to control the coalescence. When a droplet of ethanol is deposited near the "water slug," coalescence occurs and a rapid motion of the resulting mixture is observed.

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