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Reaction-diffusion in microdroplets: Theory & Experiments ETIENNE FRADET, CHARLES N. BAROUD, LadHyX — We study the dynamics of the reaction front that forms as two initially separated reactants meet. The reactants are initially contained in two different nanoliter droplets confined in a microfluidic device. Guiding and trapping the drops is performed using the *rails* and *anchors* technique. A laser pulse then triggers the chemical reaction by coalescing the drops and we monitor the integral of the reaction product. An asymptotic analysis (Trevelyan, Phys. Rev. E, 80, 2009) identifies two phases for this process. The production rate of the reaction is determined by diffusion in both. Initially the two reactants occupy different regions and have to diffuse to react. The product concentration integral then varies as $t^{3/2}$ with a prefactor that depends on the reaction kinetics. At large times, the reaction rate becomes limited by the diffusive supply of reactants which must travel over longer distances. The product concentration integral then increases as $t^{1/2}$ with a different prefactor containing the same physical ingredients. Confronting theory and experiment allows the measurement of physical and chemical constants.

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