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Rapid mixing of viscous liquids by electrical coiling TIANTIAN KONG, JINGMEI LI, ZHOU LIU, LIQIU WANG, HO CHEUNG SHUM, University of Hong Kong — We study the coiling of viscous liquid jets under an axial electric field. As a viscous jet accelerated by the electric field encounters a solid substrate, it is forced to decelerate, leading a compressive force that sets the jet to coil. We show that the coiling characteristics are significantly influenced by the applied electric force. Based on a balance between the electric and viscous torque, we deduce a scaling law to predict the coiling frequency from the relevant physical parameters, including the viscosity, dielectric constant, volumetric flow rate of the liquid and the applied electric field intensity. Moreover, we exploit this electrically controlled coiling to achieve rapid mixing between viscous liquids. We show that as a compound viscous jet is induced to coil electrically, the diffusion distance between viscous liquids is significantly reduced. As such, the mixing is enhanced remarkably despite the low Reynolds number, which is on the order of 10^{-7}. We further show that the degree of mixing can be precisely tuned by the applied electric force. Our approach of electric coiling offers a novel and versatile way to dispense, mix and print precursor liquids with large viscosities, including resins, food suspensions and polymer blends.

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