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Fluid Shearing for Accelerated Chemical Reactions - Fluid Mechanics in the VFD EVGENIA LEIVADAROU, STUART DALZIEL, Univ of Cambridge, G. K. BATCHELOR LABORATORY, DEPARTMENT OF APPLIED MATHEMATICS AND THEORETICAL PHYSICS TEAM — The Vortex Fluidic Device (VFD) is a rapidly rotating tube that can operate under continuous flow with a jet feeding liquid reactants to the tube's hemispherical base. It is a new 'green' approach to the organic synthesis with many industrial applications in cosmetics, protein folding and pharmaceutical production. The rate of reaction in the VFD is enhanced when the collision rate is increased. The aim of the project is to explain the fluid mechanics and optimize the performance of the device. One contribution to the increased yield is believed to be the high levels of shear stress. We attempt to enhance the shear stress by achieving high velocity gradients in the boundary layers. Another factor is the uncontrolled vibrations due to imperfections in the bearings and therefore it is important to assess their influence in the initial spreading. The surface area of the film should be maximized with respect to the rotation rate, geometry and orientation of the tube, flow rate, wettability and contact line dynamics. Experiments are presented for a flat disk and a curved bowl, establishing the optimum height of release, rotation rate and tube orientation. Vibrations were imposed to investigate the changes in the film formation. We discuss the implications of our results in the VFD.

Evgenia Leivadarou
Univ of Cambridge

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