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Efficiency enhancement of membraneless fuel cells by using Dean vortices MASSIMILIANO ROSSI, CHRISTIAN J. KÄHLER, Bundeswehr University Munich — To prove the concept of efficiency enhancement of membraneless fuel cells (Ferrigno et al., J. Am. Chem. Soc., 2002) by means of Dean vortices, we performed detailed experiments using Astigmatic Particle Tracking velocimetry (Cierpka et al., Meas. Sci. Technol., 2011). The basic idea is to use transversal secondary flows to stir the fluid inside the two co-laminar streams of the fuel cell (Yoon et al., Lab chip, 2006). To systematically characterize the performance of this approach, we proposed to measure simultaneously the voltage/current intensity output of the device and the corresponding 3D velocity field for different geometries and flow regimes. In this work, we show the first results obtained on a fuel cell with rectangular cross-section of 600 μm x 400 μm and radius of curvature $r = 1$ mm. A device with the same cross-section and a straight microchannel was used as a reference. Different flow rates were investigated leading to Reynolds numbers from 3.6 to 18. Additionally, to study the implications of possible variations of the co-laminar stream configuration, the topology of the interface between the two streams was measured using a particle-based interface reconstruction approach (Rossi et al., Meas. Sci. Technol., 2011).

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