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Response of microfluidic fuel cells to secondary flows MASSIMILIANO ROSSI, CHRISTIAN J. KÄHLER, Bundeswehr University Munich — Microfluidic or membraneless fuel cells (MFCs) are a recent class of miniaturized fuel cells (Ferrigno et al. 2002, Choban et al. 2004) composed by a microchannel in which a parallel laminar stream of two fluids, a fuel and an oxidant, is established. The fuel and oxidant remain in contact but do not mix due to the absence of turbulence. The simple architecture and the fact that no expensive proton exchange membranes are needed make this configuration technologically very attractive, however the efficiency especially in terms of fuel utilization is still too low to be competitive for practical applications. One limitation is given by the formation of depletion boundary layers at the electrodes that worsen the red-ox reactions. A way to reduce this problem is to use transversal secondary flows to stir the fluid streams and replenish the depletion layers. In this study, we intend to characterize the performance of MFC with curved channels in which the transversal secondary flows are present in the form of two counter-rotating vortices known as Dean vortices. The characterization will be completed by simultaneous measurements of the current intensity and of the flow velocity performed with 3D Astigmatic Particle Tracking Velocimetry.

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