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Flow distribution in 4 channels junctions at low Reynolds numbers as a function of the junction angle[1] J.P. HULIN, L. TALON, D. ETIEN, H. AURADOU, UPMC and Paris-Sud Universities, FAST Lab., Orsay (France)., M. CACHILE, GMP-FIUBA, Buenos-Aires (Argentina), J.M. GOMBA, IFAS, UNCPBA, Tandil (Argentina) — Flow distribution in junctions is a key issue in microfluidics processes. We study a junction between 4 straight channels facing each other by pairs and in which fluid is injected in two facing channels at a low Reynolds number (fluorescent dye is added in one channel). LIF measurements are performed in transparent millimetric models together with 2D FEM simulations using the Stokes equation. For equal injection flow rates on both sides, the fraction of the injected fluorescent fluid leaving in the outflow channel at the lowest angle α from the injection is always larger than 0.5 (or equal for $\alpha = 90°$) and increases as α decreases. Surprisingly, this fraction becomes equal to 1 below a threshold non-zero value $\alpha_c \simeq 30°$ (the fluid "bounces back" at the junction). For $\alpha \leq \alpha_c$, recirculation cells appear at the center of the junction and increase in size and number as α goes to zero. Moving the LIF measurement plane perpendicular to that of the junction shows a $2D$ structure of the flow at low Reynolds numbers while $3D$ features appear at larger ones.

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