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Study of gas-liquid flow in model porous media for heterogeneous catalysis[1] MARIE FRANCOIS, HUGUES BODIGUEL, PIERRE GUILLOT, Laboratory of the Future, LABORATORY OF THE FUTURE TEAM — Heterogeneous catalysis of chemical reactions involving a gas and a liquid phase is usually achieved in fixed bed reactors. Four hydrodynamic regimes have been observed. They depend on the total flow rate and the ratio between liquid and gas flow rate. Flow properties in these regimes influence transfer rates. Rather few attempts to access local characterization have been proposed yet, though these seem to be necessary to better describe the physical mechanisms involved. In this work, we propose to mimic slices of reactor by using two-dimensional porous media. We have developed a two-dimensional system that is transparent to allow the direct observation of the flow and the phase distribution. While varying the total flow rate and the gas/liquid flow rate ratio, we observe two hydrodynamic regimes: at low flow rate, the gaseous phase is continuous (trickle flow), while it is discontinuous at higher flow rate (pulsed flow). Thanks to some image analysis techniques, we are able to quantify the local apparent liquid saturation in the system. Its fluctuations in time are characteristic of the transition between the two regimes: at low liquid flow rates, they are negligible since the liquid/gas interface is fixed, whereas at higher flow rates we observe an alternation between liquid and gas. This transition between trickle to pulsed flow is in relative good agreement with the existing state of art. However, we report in the pulsed regime important flow heterogeneities at the scale of a few pores. These heterogeneities are likely to have a strong influence on mass transfers.

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