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Switchable imbibition in nanoporous gold PATRICK HUBER, Institute of Materials Physics and Technology, Hamburg University of Technology, JUERGEN MARKMANN, Insitute of Materials Research, Materials Mechanics, Helmholtz-Zentrum Geesthacht, HUILING DUAN, State Key Laboratory for Turbulence and Complex Systems, Peking University, JOERG WEISSMUELLER, Institute of Materials Physics and Technology, Hamburg University of Technology, YAHUI XUE, State Key Laboratory for Turbulence and Complex Systems, Peking University — Spontaneous imbibition enables the elegant propelling of nano-flows because of the dominance of capillarity at small length scales. The imbibition kinetics are, however, solely determined by the static host geometry, the capillarity, and the fluidity of the imbibed liquid. This makes active control particularly challenging. Here we show for aqueous electrolyte imbibition in nanoporous gold that the fluid flow can be reversibly switched on and off through electric potential control of the solidliquid interfacial tension, that is, we can accelerate the imbibition front, stop it, and have it proceed at will. Simultaneous measurements of the mass flux and the electrical current allow us to document simple scaling laws for the imbibition kinetics, and to explore the charge transport in the metallic nanopores. Our findings demonstrate that the high electric conductivity along with the pathways for fluid/ionic transport render nanoporous gold a versatile, accurately controllable electrocapillary pump and flow sensor for minute amounts of liquids with exceptionally low operating voltages. (1) Yahui Xue, Juergen Markmann, Huiling Duan, Joerg Weissmueller, Patrick Huber, Nature Communications 5, 4237 (2014).

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