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Insights from plants: tunable nano-flows induced by drying OLIVIER VINCENT, ANTOINE ROBIN, ALEXANDRE SZENICER, ABRAHAM STROOCK, Cornell University — Moving fluids through nanoscale confinements is a difficult process due to high friction with the walls. Pushing fluids to achieve significant (or even measurable) flows requires very large pressures, which can be inconvenient and costly. Inspired by plants, we used evaporation to generate controlled steady-state nano-flows in pores $\sim$ 3 nm in diameter embedded in a silicon-based micro-platform. The capillary negative pressure that drives the flow, on the order of tens to hundreds of MPa in magnitude, develops spontaneously upon drying and can be externally tuned by changing the relative humidity (vapor saturation) outside of the sample. We show that the analysis of the dynamic drying response allows to get precise measurements of the behavior of highly confined liquids and could be used both as tool for the study of nanoscale fluid physics and as a method to handle liquids in a controlled way for lab-on-chip applications. We also discuss flow enhancement possibilities based on ideas from the vascular anatomy of plants.

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