Sub–10 nm polyamide nanofilms with ultrafast solvent transport for molecular separation

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Membranes with unprecedented solvent permeance and high retention of dissolved solutes are needed to reduce the energy consumed by separations in organic liquids. We used controlled interfacial polymerization to form free-standing polyamide nanofilms less than 10 nanometers in thickness, and incorporated them as separating layers in composite membranes. Manipulation of nanofilm morphology by control of interfacial reaction conditions enabled the creation of smooth or crumpled textures; the nanofilms were sufficiently rigid that the crumpled textures could withstand pressurized filtration, resulting in increased permeable area. Composite membranes comprising crumpled nanofilms on alumina supports provided high retention of solutes, with acetonitrile permeances up to 112 liters per square meter per hour per bar. This is more than two orders of magnitude higher than permeances of commercially available membranes with equivalent solute retention.

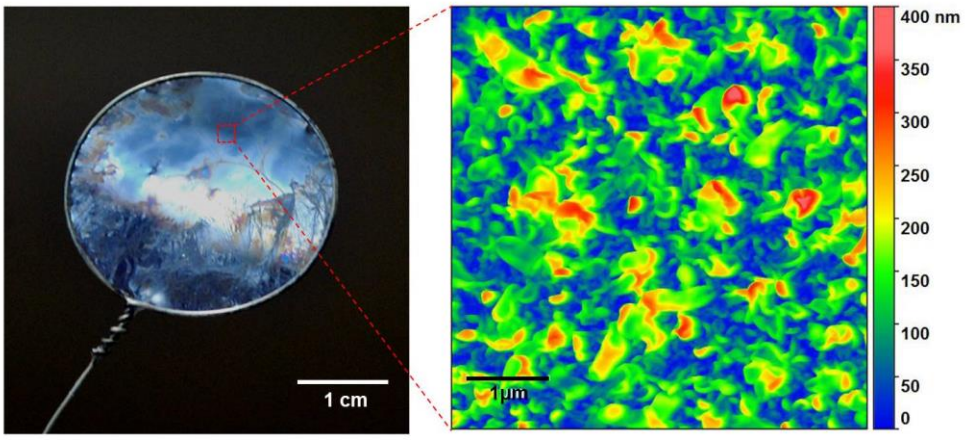


Figure 1. Freestanding sub-10 nm polyamide nanofilm on a lasso and the AFM image showing crumpled features.

References

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