Desalination in high-surface area membranes templated by bicontinuous interfacially jammed emulsion gels

Henrik Siegel, h.siegel@uu.nl

Sponsor: NWO, since March 2021
Supervisor: dr. Martin Haase

Keywords:
Bijel, Confocal microscopy, Desalination

Bijels (bicontinuous interfacially jammed emulsion gels) are formed by arresting the spinodal decomposition of two immiscible liquids with surface active nanoparticles. This results in an interwoven fluid network separated by a percolating film of nanoparticles. The percolating nanoparticle film provides the bijel with a large internal surface area and a distinct pore network with pore sizes ranging from 100 nm to 5 µm. On this internal surface, a semipermeable membrane will be synthesized to facilitate reverse osmosis and/or nanofiltration.

To separate hydrated salt ions or dissolved organic molecules, the pores of the bijel are connected to both feed and concentrate flow side of the membrane. A key challenge in membrane application is overcoming concentration polarization in the bijel network due to salt accumulation. Thus, engineering and implementing a tailored drainage structure into the membrane will be investigated in the project.

The performance of the high-surface area membrane is evaluated by measuring the permeate flux, as well as the solute concentrations in permeate and concentrate streams. Confocal laser scanning microscopy is employed to spatially visualize the concentration profiles of solutes within the membrane by using fluorescent tracer molecules.