Printed Polyamide Membranes: Smooth Thin Film Composite Membranes with Tunable Thickness

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Interfacial polymerization, while effective at making thin film composite desalination membranes of high permeability and selectivity, is a relatively uncontrolled process that prevents tuning of polyamide film thickness or roughness. A new approach is presented which uses electrospraying to deposit monomer solutions in nanoscale droplets directly onto a substrate where they subsequently react to form the crosslinked polyamide film essentially on any surface. This printing approach enables film thickness control to 4 nm resolution (~20 nm total thickness) and achieves films with a root mean square roughness as low as 2 nm. The higher performing membranes in this study exceeded both the permeance (as much as a 10-fold improvement) and selectivity (notably higher salt rejections) of commercially available reverse osmosis membranes in addition to their substantially lower roughness.



