# Origin of light-driven composition asymmetry in reactive solution coatings

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We developed a simple versatile route to fabricate porous asymmetric polymer coatings by combining a photo-induced phase separation and solvent evaporation. Upon a short-time (<10 s) irradiation of ultra-violet light onto a photo-reactive ternary solution coating, radical polymerization reactions induced not only a composition asymmetry across the thickness but also a spontaneous phase separation between solvent-rich and polymer-rich phases. The subsequent solvent evaporation from the former phase lead to create pores of 30 – 100 nm in diameters. The local concentration measurements revealed the increase in solvent concentration along the direction of light irradiation, showing an evolution of light-driven asymmetry. The composition asymmetry was maximized at a certain intermediate light intensity, while the distribution of unreacted monomers remained uniform. Furthermore, one-shot UV irradiation enabled us to create non-linear, stepwise polymer distributions across the coating, depending upon curing and pre-drying conditions.