Abstract

Phase inversion of polymer casting mixtures filled with hierarchical functional nanostructures is proposed as a synthetic route for the design of multifunctional membranes. The structure and reactivity of such membranes can be independently controlled by regulating the relative content of components representing different levels in the nanofiller hierarchy. Exfoliated graphite nanoplatelets decorated by Au nanoparticles are used as a model hierarchical nanofiller. The resulting porous asymmetric nanocomposites are shown to be catalytically active ultrafiltration membranes that are more resistant to compaction, more permeable than filler-free membranes and at least as selective. By designing membrane compositions with different relative amounts of nanogold and graphene, the structure (controlled by the loading of graphene) and catalytic activity (controlled by the loading of nanogold) can be controlled independently. Decreased loss of nanoparticles by the nanocomposites membranes is another potential benefit of anchoring functional nanoparticles to the larger carrier “mats”.