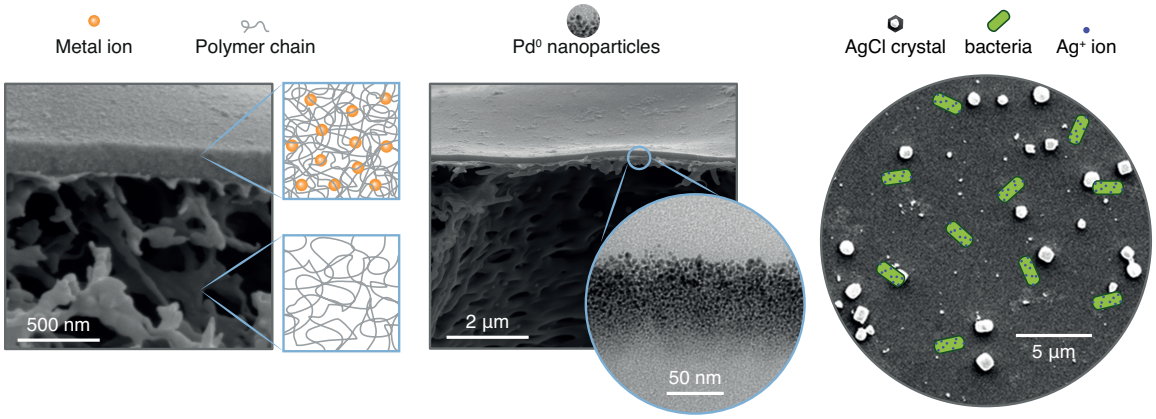
Metal-rich polymer membranes by CIPS: from metal ions to crystals.

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The majority of state-of-the-art polymeric membranes for industrial or medical applications are fabricated by phase inversion. Complexation induced phase separation (CIPS)—a surprising variation of this well-known process—allows direct fabrication of hybrid membranes in existing facilities.[1] In the CIPS process, a first step forms the thin metal-rich selective layer of the membrane, and a succeeding step the porous support. Precipitation of the selective layer takes place in the same solvent used to dissolve the polymer and is induced by a small concentration of metal ions. These ions form metal-coordination-based crosslinks leading to the formation of a solid skin floating on top of the liquid polymer film. A subsequent precipitation in a non-solvent bath leads to the formation of the porous support structure. The thickness and morphology of the dense layer as well as the porosity of the support can be controlled over a wide range by manipulating simple process parameters.

The nature of the CIPS process facilitates a precise loading of a high concentration of metal ions that are located in only the top layer of the membrane. Moreover, these metal ions can be converted—during the membrane fabrication process—to nanoparticles or crystals. During the lecture the CIPS process will be discussed, and examples of membranes containing metal ions, metal nanoparticles and metal salt crystals presented. This simple method opens up fascinating possibilities for the fabrication of metal-rich polymeric membranes with a new set of properties. Two promising applications of such membranes will be presented: (i) catalytic membranes containing palladium nanoparticles (PdNPs),[2] and (ii) antibiofouling tight-UF membranes containing silver chloride (AgCl) crystals.



(1) Villalobos, L. F.; Karunakaran, M.; Peinemann, K.-V. Complexation-Induced Phase Separation: Preparation of Composite Membranes with a Nanometer-Thin Dense Skin Loaded with Metal Ions. *Nano Lett*. **2015,** *15*, (5), 3166-3171.
(2) Villalobos, L. F.; Xie, Y.; Nunes S.; Peinemann, K.-V. Polymer and Membrane Design for Low Temperature Catalytic Reactions. *Macromol. Rapid Comm*. doi: 10.1002/marc.201500735