



Science Week

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Polymer membranes analyzed by Elastic Recoil Detection and Positron Annihilation Lifetime Spectroscopy

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Extensive characterization is needed to understand the physicochemical properties of polymeric membranes that are used for water purification. Currently, most techniques characterize the (near)-surface region of the membrane, even though its bulk obviously also plays a significant role in the final membrane performance. To achieve depth-profiles of the elemental composition of both integrally skinned asymmetric (ISA) and thin-film composite (TFC) membranes, elastic recoil detection (ERD) is introduced to the field. Volume-averaged chlorine-uptake as well as complete Cl- and H-profiles as a function of membrane depth were obtained after NaOCl cleaning procedures at high pressures (e.g. 10 bar for 2.5 h) of polyamide (PA)-based thin film composite (TFC) membranes. The decrease in H-content upon chlorine exposure could be quantitatively proven for the first time and the influence of pressure, pH and chlorine feed-concentration on the location of chlorine in the membrane was studied. More chlorine is present deeper in the PA-layer with increasing chlorine uptake, either by increasing chlorine dose or by decreasing pH. The chlorine uptake goes in-line with reduced positron lifetime indicating a reduction of open pore size. It demonstrates a “tightening” of the membranes with reduced water permeability.

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