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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 as a potentially highly valuable technique to complement for instance XPS, EDX or RBS. It also allows to analyse remnants from chlorination of nanofiltration (NF) and reverse osmosis (RO) membranes being of high importance for the water treatment industry. 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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