An electrical impedance spectroscopy (EIS) method and apparatus that eliminates the need for electrodes in the feed and permeate solutions was evaluated as a means of characterising physical and performance properties of polysulphone ultrafiltration membranes in situ. The membranes were sputter-coated on one side with platinum before assembly in the apparatus. Alternating electrical current used for impedance measurements was injected directly into the coat via dry electrical contacts with the edges of the membrane. As the frequency of the EIS measurement was increased the current increasingly dispersed into the solution via the interfacial region (double layer) and/or fouling layers that the coat formed with the solution. These spatial dispersions manifested as characteristic dispersions with frequency of the impedance of the system. Water flux measurements, field emission scanning electron microscopy and atomic force microscopy were also used to quantify the important membrane performance parameters of porosity and surface roughness. These estimates were in good agreement with the impedance model for the in situ membrane system that was fitted to the measured impedance dispersions.

The study shows that EIS measurements potentially can quantify membrane performance parameters in situ better than those techniques that require disruption of the membrane separation process. The method also has the potential for monitoring the deposition of particulate that can lead to fouling.