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Nanogravimetric observation of unexpected ion exchange characteristics for polypyrrole film p-doping in a deep eutectic ionic liquid

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Acoustic wave resonator and procedure for acquisition of acoustic admittance spectra

The quartz resonators were 10 MHz AT-cut crystals coated with Au (ICM, Oklahoma City, USA), with piezoelectric and electrochemically active areas of 0.21 and 0.23 cm². Film rigidity was established via crystal impedance spectra, using an Agilent Technologies E5061A network analyser with VEE v7.52 software. Resonator frequency changes were interpreted gravimetrically using the Sauerbrey equation:\[ \Delta m/\text{ng} = -1.1(\Delta f/\text{Hz}) \]. Film thickness (\( h_f \)) was determined gravimetrically, using \( \Delta f \) for film deposition and a film density of 1 g cm\(^{-3}\).

Admittance spectra

Admittance spectra acquired during deposition of a PPy film (solutions and potential control function as in main text). Trace 1: bare electrode; trace 2: after 5 deposition cycles; trace 3: after 10 deposition cycles. The overall decrease in peak admittance (from trace 1 to trace 3) is 3%; the film is acoustically thin ("rigid").