

Supporting information for *Chem. Comm.* manuscript B819084D

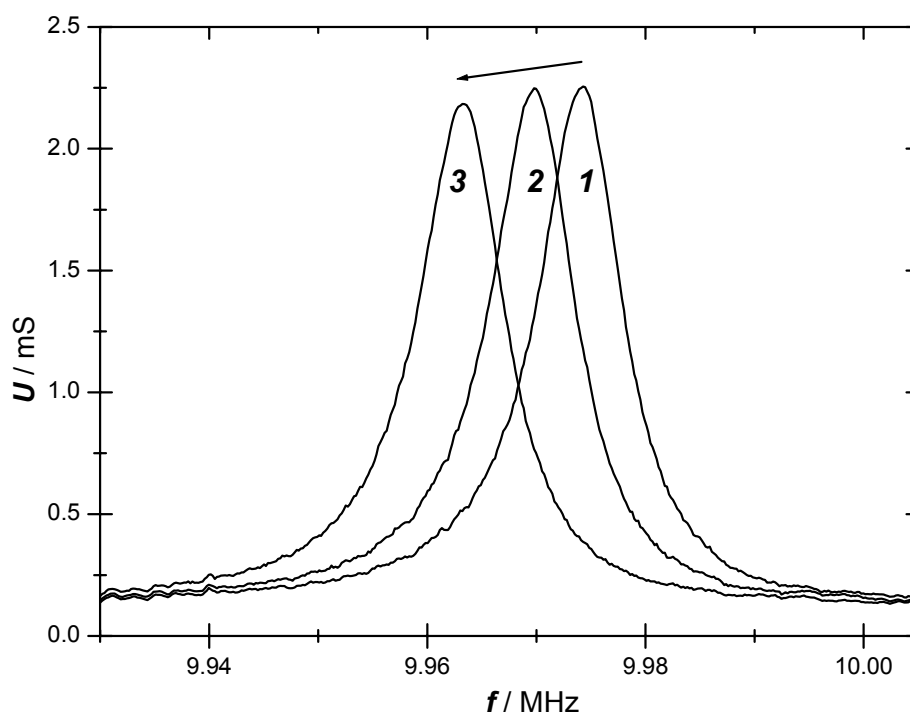
**Nanogravimetric observation of unexpected ion exchange characteristics
for polypyrrole film p-doping in a deep eutectic ionic liquid**

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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 equation¹³: for the quartz resonators used here, $\Delta m/\text{ng} = -1.1(\Delta f/\text{Hz})$. Film thickness (h_f) was determined gravimetrically, using Δf 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”).