

# Supporting Information for “A robust, water-based, functional binder framework for high energy lithium-sulfur batteries”

Matthew J. Lacey, Viking Österlund, Andreas Bergfelt, Fabian Jeschull, Tim Bowden and Daniel Brandell

## Experimental information pertaining to the Supporting Information

X-ray photoelectron spectroscopy (XPS) spectra were collected with a PHI 5500 ESCA system (Perkin Elmer) with an Al K $\alpha$  X-ray source (1486.6 eV). Binding energies were calibrated against the C1s signal from PEO at 286.4 eV from the casted electrode sample and against the major peak in KB for all other KB powder samples. The HEP spectrum was calibrated against the hydrocarbon peak at 285 eV. All intensities are presented as measured.

Thermogravimetric analysis (TGA) was performed with a Q Series TGAQ500 (TA Instruments). The measurements were made in an Al sample holder with a temperature ramp of 5 °C min<sup>-1</sup> between 500 °C under a flow of air at 60 mL min<sup>-1</sup>.

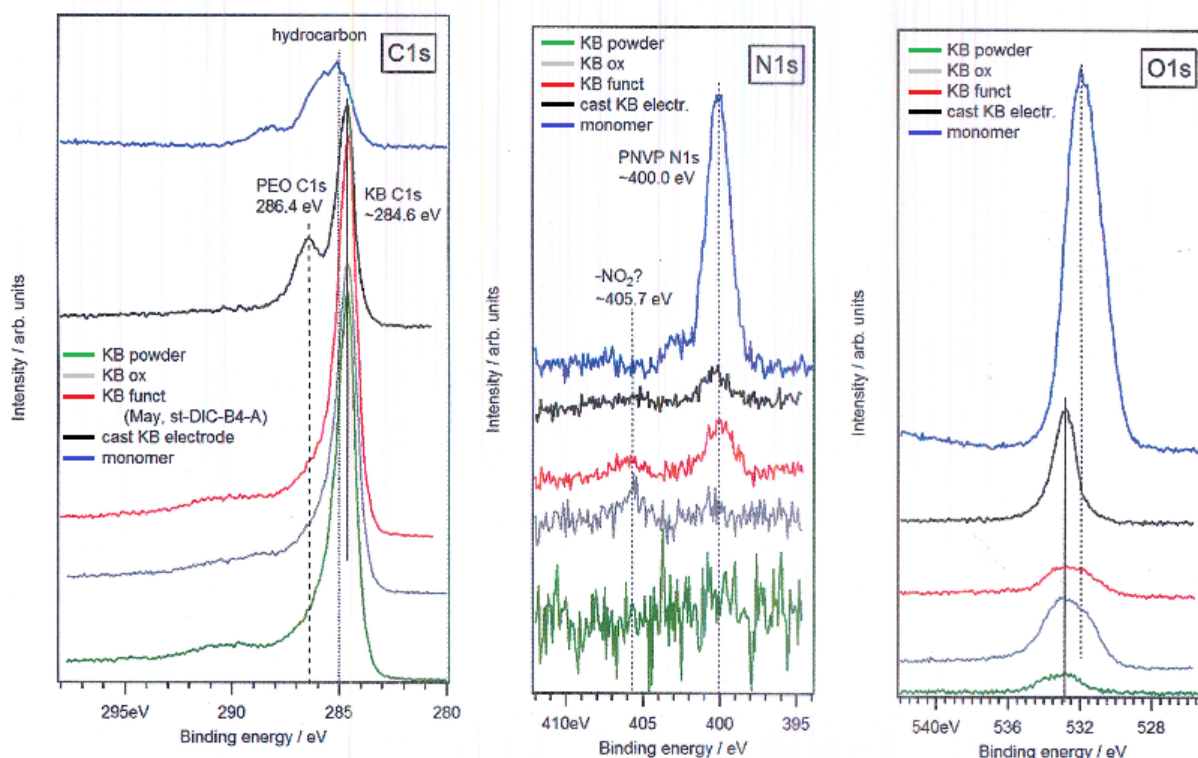


Figure S1: XPS spectra for “blank” KB powder, oxidised KB (“KB ox”), HEP-functionalised KB (“KB funct”), an as-cast electrode containing HEP-functionalised KB (“cast KB electrode”) and HEP (“monomer”).

Successful grafting of HEP on KB is evidenced by the presence of the peak at 400.0 eV in the N1s spectrum. A small signal at 405.7 eV is also seen which may be due to the presence of some nitro (-NO<sub>2</sub>) groups formed on the surface of KB as a result of the nitric acid treatment.

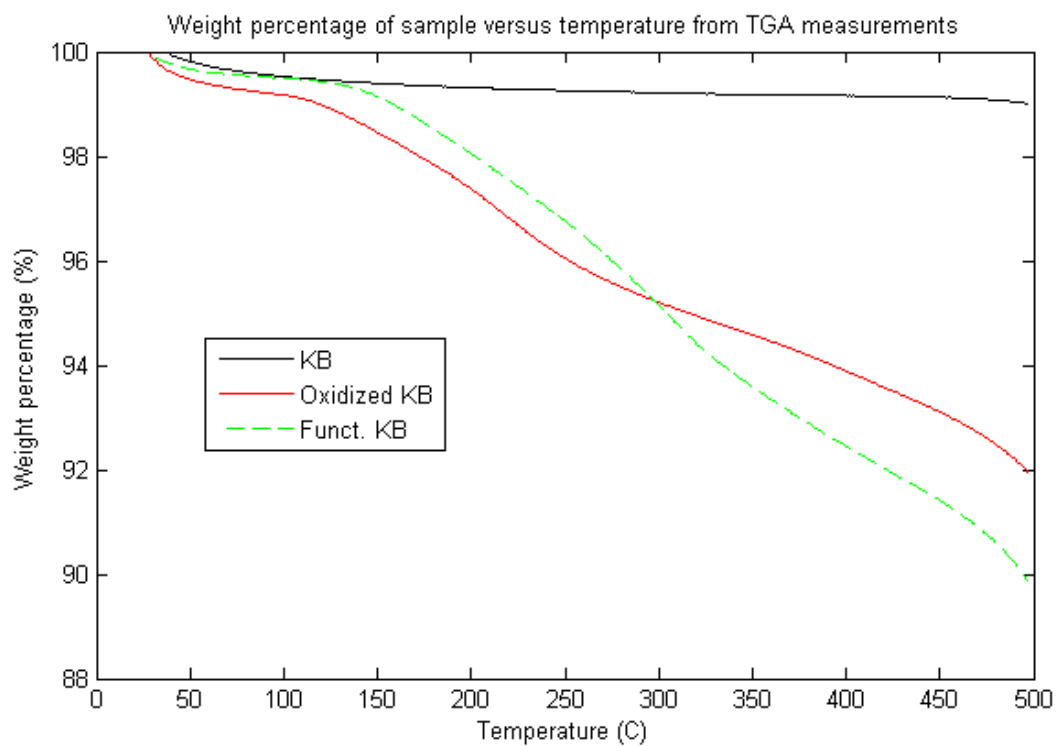


Figure S2: TGA curves for blank KB, oxidised KB and HEP-functionalised KB

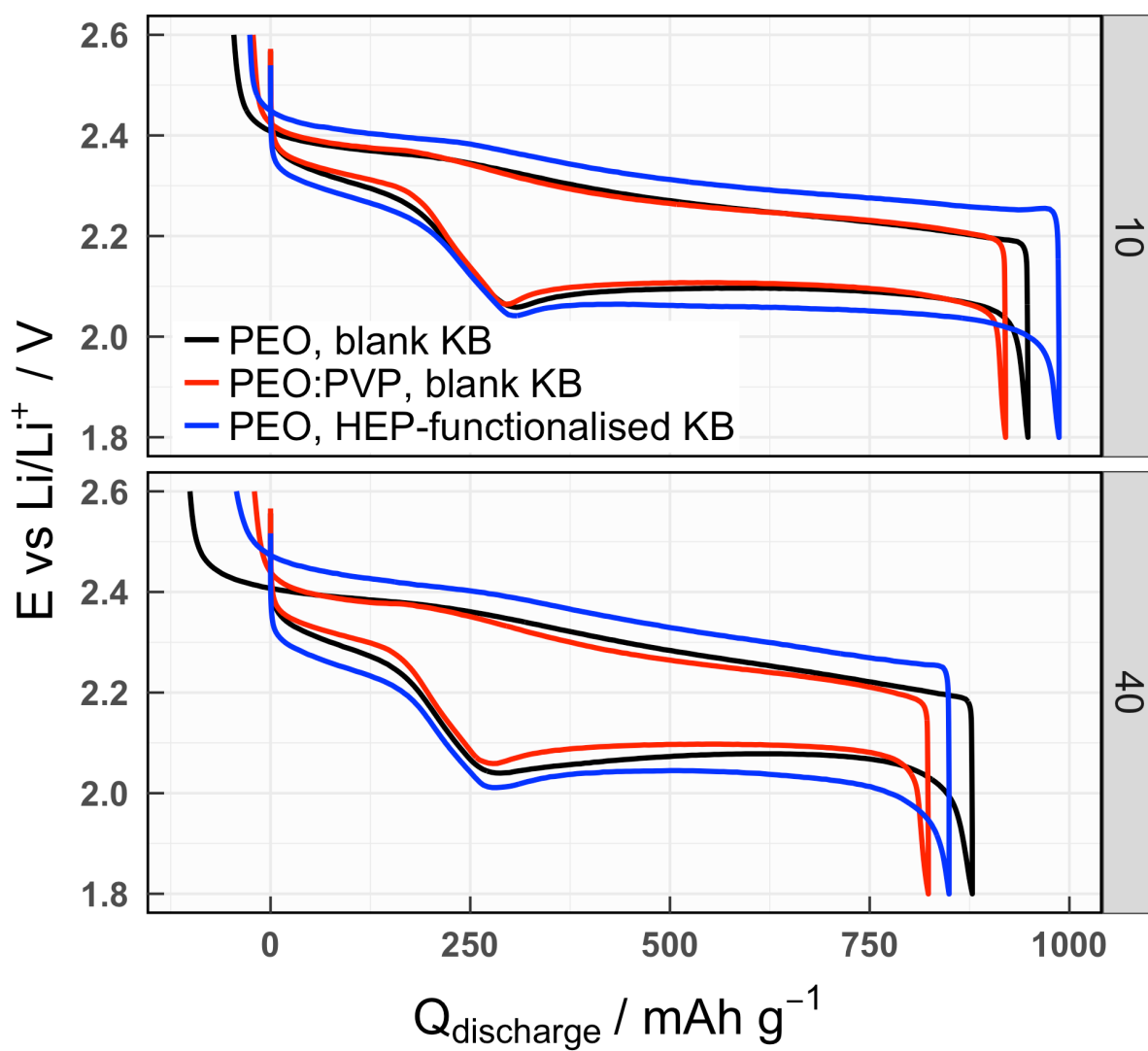


Figure S3: Voltage profiles at the 10<sup>th</sup> and 40<sup>th</sup> cycles for HEP-functionalised KB electrodes with a PEO binder compared with “blank” KB electrodes with PEO and 4:1 PEO:PVP binders at C/10 rate. Electrode loading  $\sim 1.2 \text{ mg}_s \text{ cm}^{-2}$ . Cycle number indicated on the panel on the right of the plot.



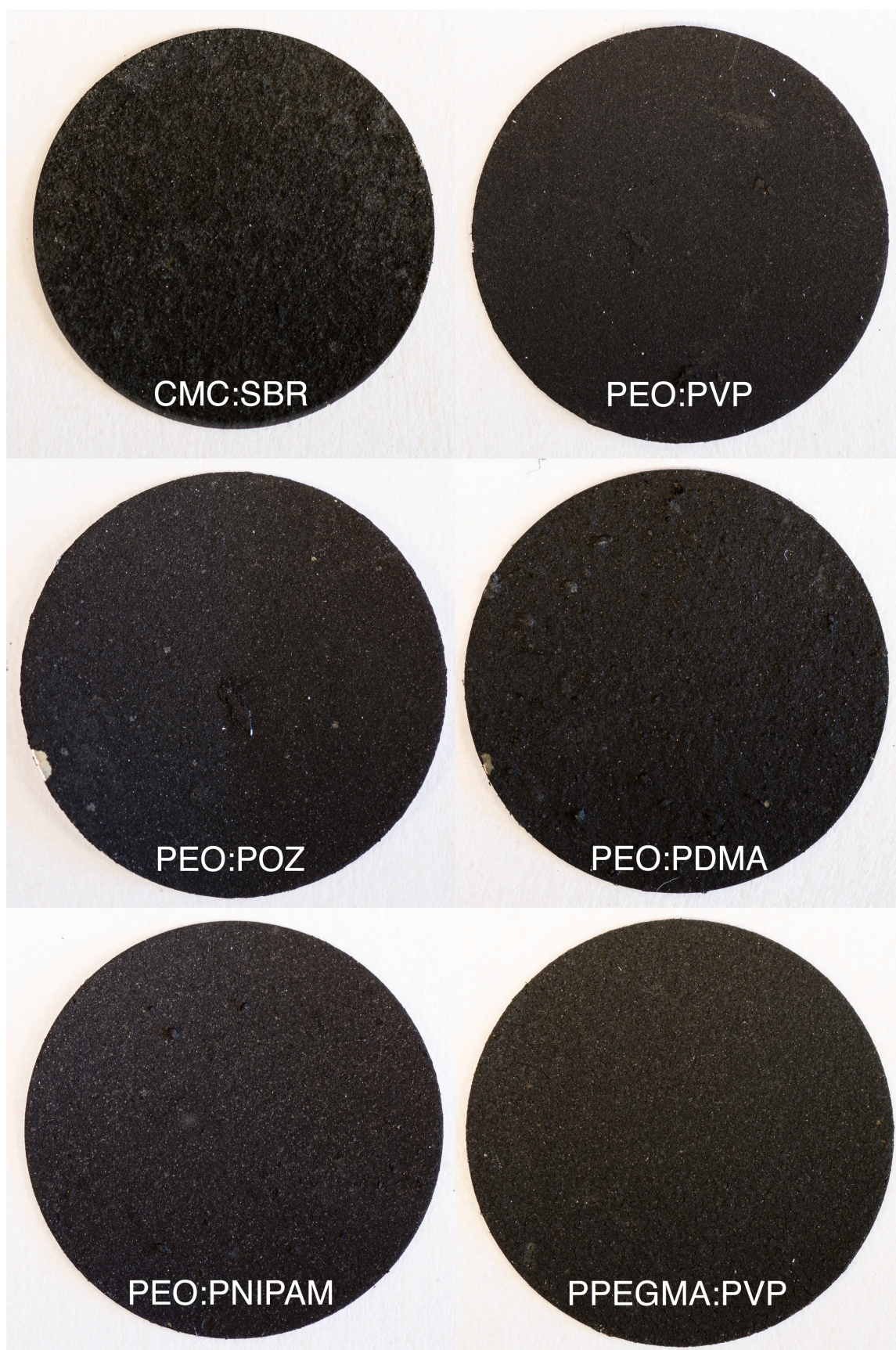


Figure S4: macro photographs of representative electrodes containing the six different binder systems investigated in this work. Sulfur loading in all cases is  $\sim 2 \text{ mg}_S \text{ cm}^{-2}$ , all electrodes are 13 mm in diameter. (Note: these images are high resolution photographs and best viewed in electronic format.)