Electronic Supplementary Information

Evaluation of polyketones with N-cyclic structure as electrode material for electrochemical energy storage: case of pyromellitic diimide dilithium salt

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Contents

1. Experimental details

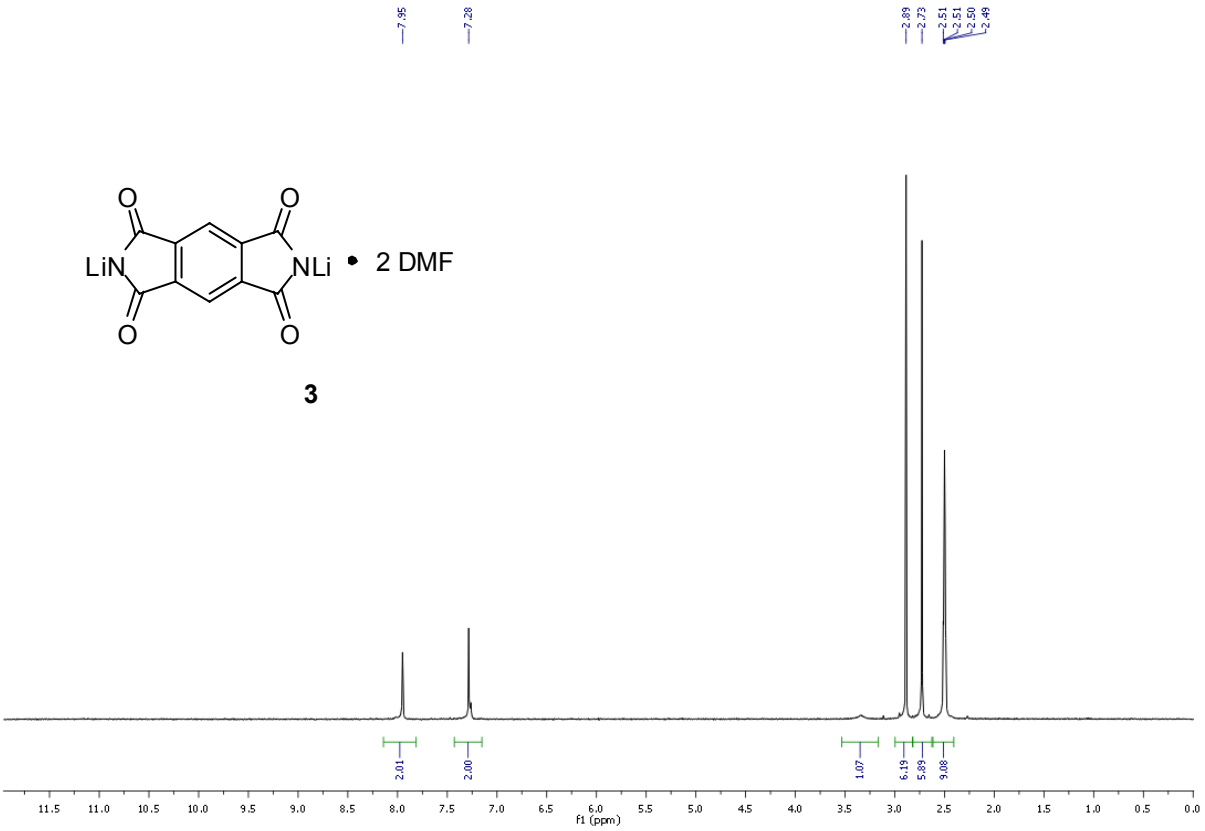
General Methods

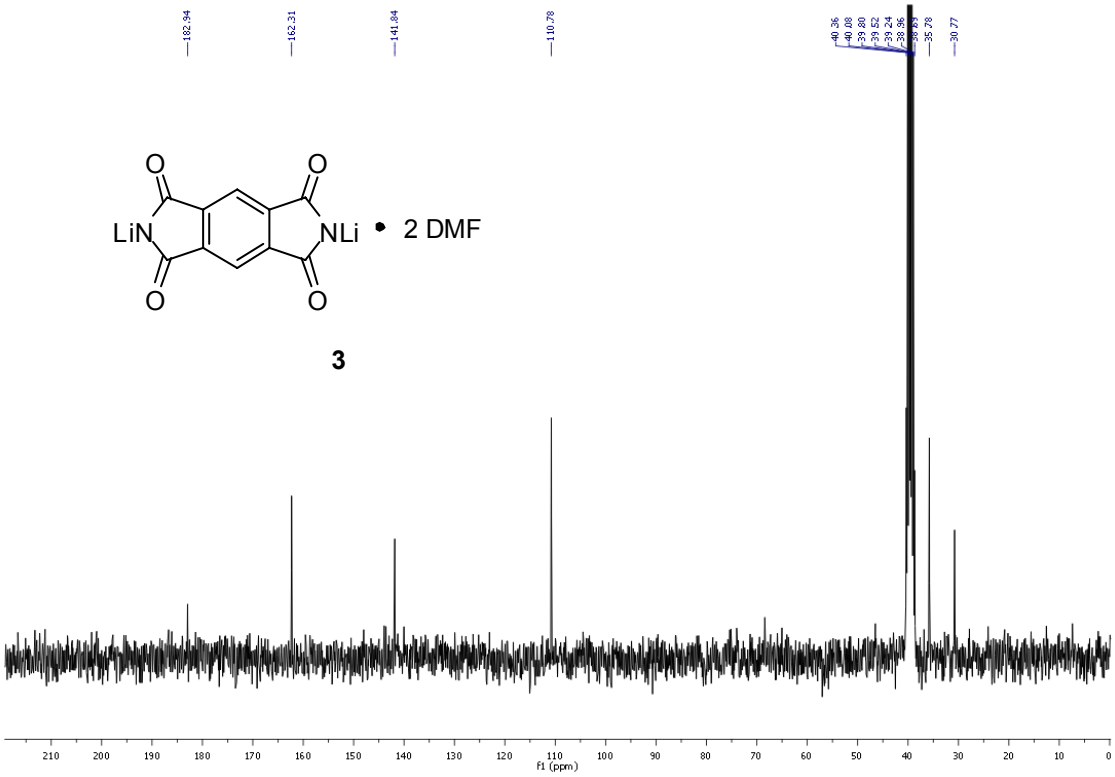
Solvents and reagents were purchased from Alfa Aesar and were stored under argon in a glovebox. ^{1}H and ^{13}C NMR spectra were recorded at 300 MHz and 75 MHz on a BRUKER DMX 300, at room temperature, respectively. Chemical shifts (δ) were expressed in part per million (ppm) relative to residual DMSO-d_6 or an internal standard. Infrared spectra were performed with a SHIMADZU 8400S FTIR spectrophotometer in the 600-4000 cm^{-1} frequency range equipped with an attenuated total reflectance probe (ATR). Electrochemical performances were tested *vs.* lithium in Swagelok®-type cells using Li metal disc as negative electrode and a fibreglass separator soaked with a molar LiTFSI solution in DMC as the electrolyte. Positive electrode was prepared without binder by mixing organic compounds with 33% carbon SP (in total mass). Cells were cycled in galvanostatic mode using a Macpile or a VMP system (Biologic S.A., Claix, France) at a typical rate of one lithium ion exchanged in 5 or 20 h (denoted 1 Li^{+}/5 h or 1 Li^{+}/20 h).

Synthesis of pyromellitic diimide dilithium salt (4)

31.8 mg of lithium hydride (4 mmol) were added to a solution of 432 mg of pyromellitic diimide (2 mmol) in 4 mL of DMF in a flask in a glovebox. The reaction mixture was stirred at room temperature during 28 hours to produce compound **3**. DMF was then eliminated from **3**, under reduce pressure. The resulting pale yellow powder was then heated in a horizontal tubular oven under inert atmosphere at 330°C for 2 hours and 415 mg of a brown powder was obtained (yield = 91%); ν_{max}/cm^{-1} 1738, 1574, 1453, 1389, 1306, 1186, 1136; ^{1}H NMR (300 MHz, DMSO-d_6) δ (ppm): 7.21; ^{13}C NMR (75 MHz, DMSO-d_6) δ (ppm) : 110.9 (**C**–H); 142.0 (**C**–CO) ; 183.6 (**C**=O). Elemental analysis (Found: C, 52.4; H, 1.0; N, 12.3; Li, 5.8. $C_{10}H_2Li_2N_2O_4$ requires C, 52.7; H, 0.9; N, 12.3; Li, 6.1%)

2. **Figure S1**: ^{1}H and ^{13}C NMR spectra of **3**





3. Figure S2: Thermal analysis of **3**