# Supporting Information

## Solution-Processable Novel Near-Infrared Electrochromic Aromatic Polyamides Based on Electroactive Tetraphenyl-*p*-Phenylenediamine Moieties

By *Hung-Ju Yen*, and *Guey-Sheng Liou**

Functional Polymeric Materials Laboratory, Institute of Polymer Science and Engineering, National Taiwan University, Taipei, Taiwan

Tel: +886-2-336-5315; Fax: +886-2-336-5237; E-mail: gsliou@ntu.edu.tw

**List of Contents for Supplementary Material:**

**Table S1.** Inherent Viscosity[a] and Molecular Weights[b] of Polyamides

| polymer | $\eta_{inh}$ (dL/g) | $M_w$ | $M_n$ | PDI[c] | DP[d] |
|---|---|---|---|---|---|
| **Ia** | 0.73 | 49,000 | 33,900 | 1.45 | 50.7 |
| **Ib** | 0.51 | 147,600 | 81,700 | 1.81 | 108.2 |
| **Ic** | 0.48 | 237,800 | 122,500 | 1.94 | 137.8 |

[a] Measured at a polymer concentration of 0.5 g/dL in DMAc at 30 °C. [b] Calibrated with polystyrene standards, using DMF as the eluent at a constant flow rate of 1 mL/min at 70 °C. [c] Polydispersity Index = $M_w/M_n$. [d] Degree of Polymerization.

**Table S2.** Solubility Behavior of Polyamides

| Code | Solubility in various Solvent[a] | | | | | | |
|---|---|---|---|---|---|---|---|
| | NMP | DMAc | DMF | DMSO | *m*-Cresol | THF | $CHCl_3$ |
| **Ia** | + + | + + | + | + | + | - | - |
| **Ib** | + + | + + | + + | + + | + + | + - | - |
| **Ic** | + + | + + | + + | + + | + + | + + | - |
| **I'b** | + + | + + | + + | + | + + | - | - |

[a] The solubility was determined with a 20 mg sample in 2 mL of a solvent. + +, soluble at room temperature; +, soluble on heating; + -, partially soluble or swelling; -, insoluble even on heating. THF: tetrahydrofuran; $CHCl_3$: chloroform.

**Table S3.** Thermal Properties of Polyamides

| Polymer[a] | $T_g$ (°C)[b] | $T_d^5$ (°C)[c] | | $T_d^{10}$ (°C)[c] | | $R_{w800}$ (%)[d] |
|---|---|---|---|---|---|---|
| | | $N_2$ | Air | $N_2$ | Air | |
| **Ia** | 246 | 460 | 445 | 480 | 460 | 58 |
| **Ib** | 236 | 475 | 470 | 505 | 505 | 68 |
| **Ic** | 245 | 500 | 475 | 535 | 520 | 65 |
| **I'b** | 252 | 520 | 505 | 570 | 570 | 67 |

[a] The polymer film samples were heated at 300 °C for 1 h prior to all the thermal analyses. [b] Midpoint temperature of baseline shift on the second DSC heating trace (rate: 20 °C /min) of the sample after quenching from 400 °C to 50 °C (rate: 200 °C /min) in nitrogen. [c] Temperature at which 5 % and 10% weight loss occurred, respectively, recorded by TGA at a heating rate of 20 °C/min and a gas flow rate of 20 $cm^3$/min. [d] Residual weight percentages at 800 °C under nitrogen flow.

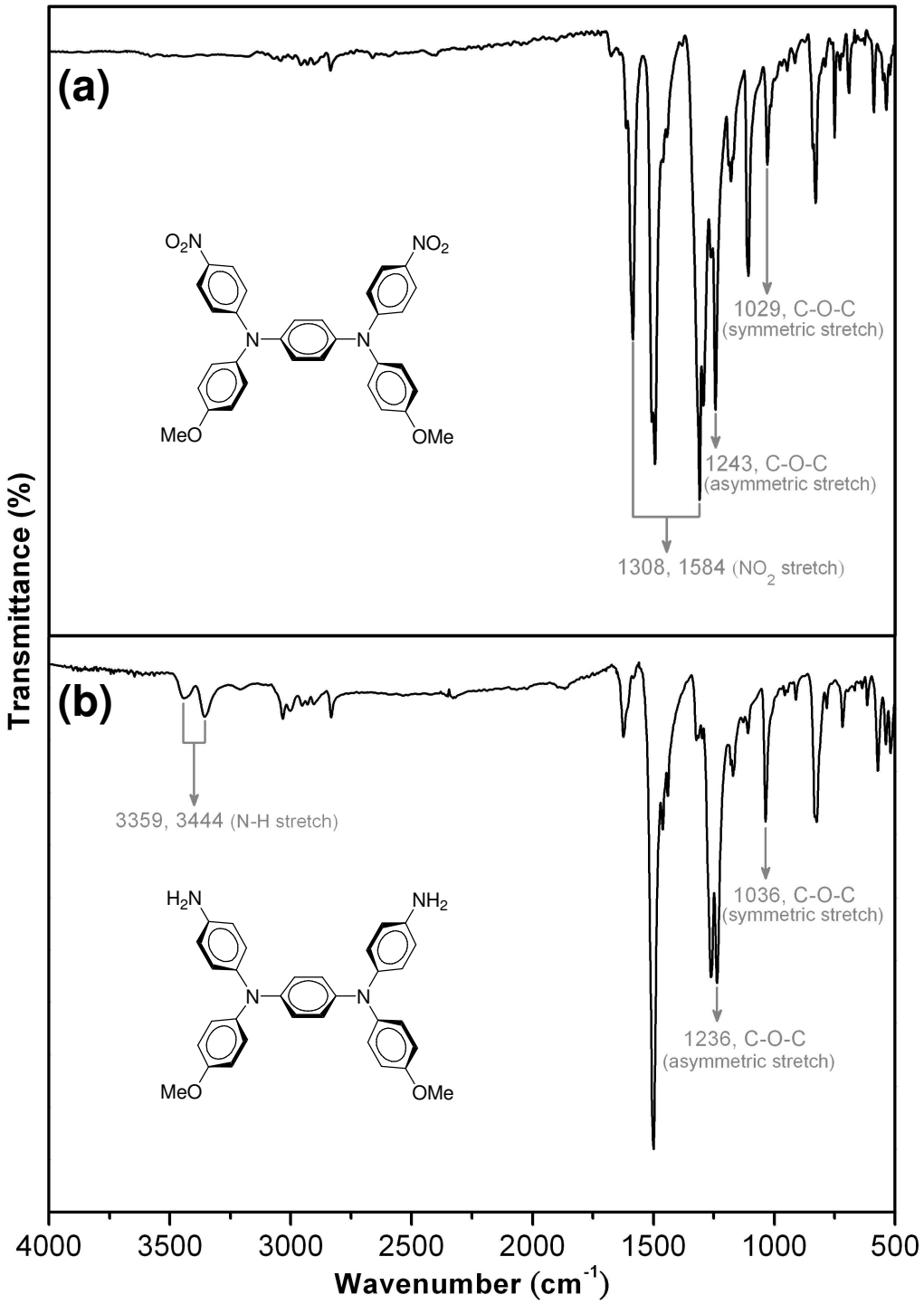


**Figure S1.** IR spectra of (a) $(OMe)_2$TPPA-dinitro compound **1** and (b) $(OMe)_2$TPPA-diamine monomer **2.**

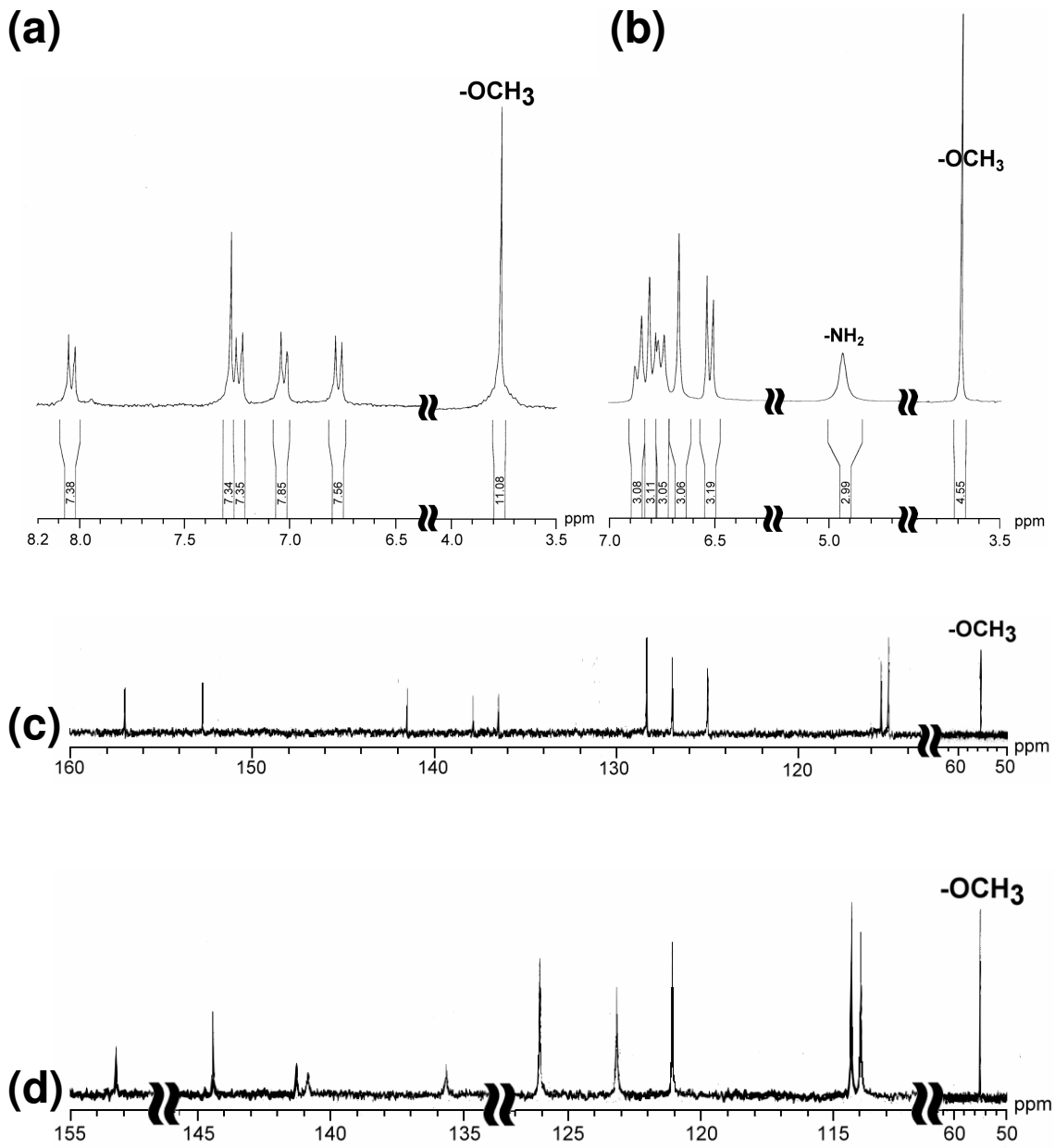


**Figure S2.** $^{1}$H NMR spectra of (a) compound **1**, (b) monomer **2** and $^{13}$C NMR spectra of (c) compound **1**, (d) monomer **2** in DMSO-$d_6$.

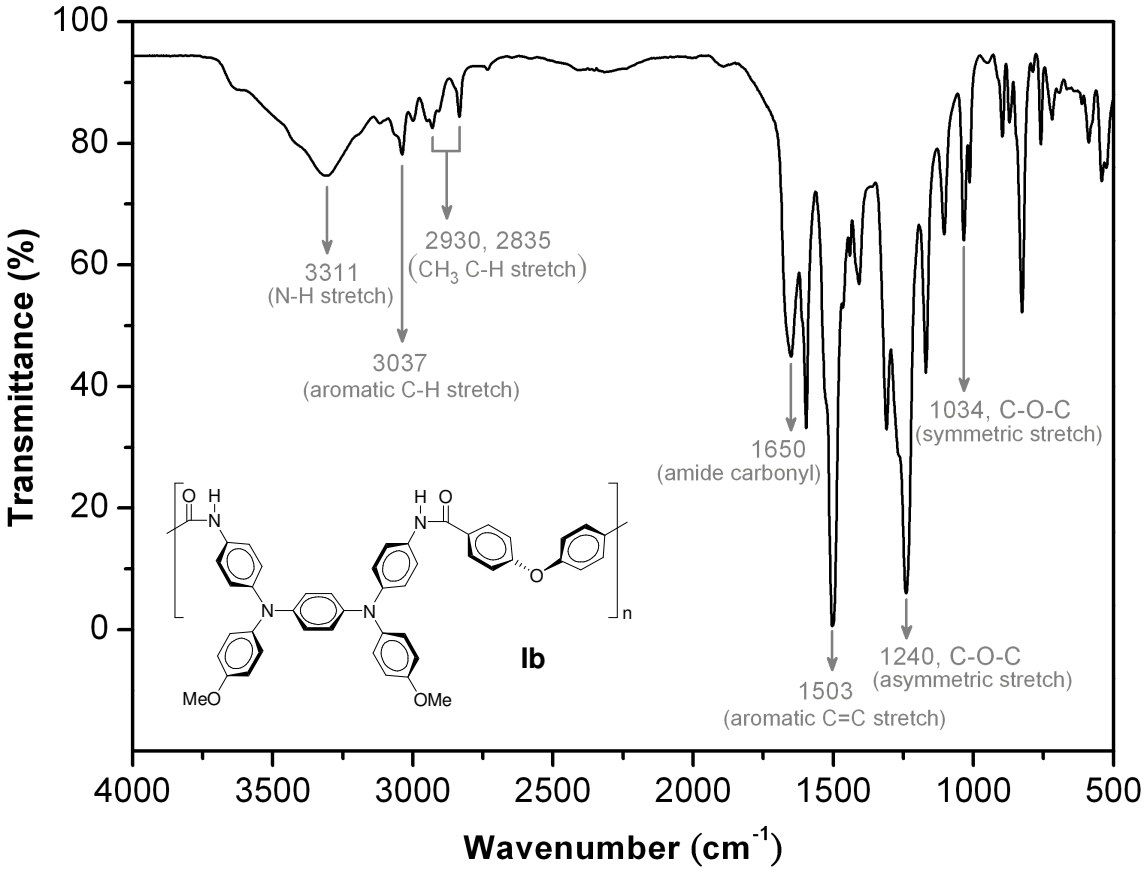


**Figure S3.** IR spectrum of polyamide **Ib** film.

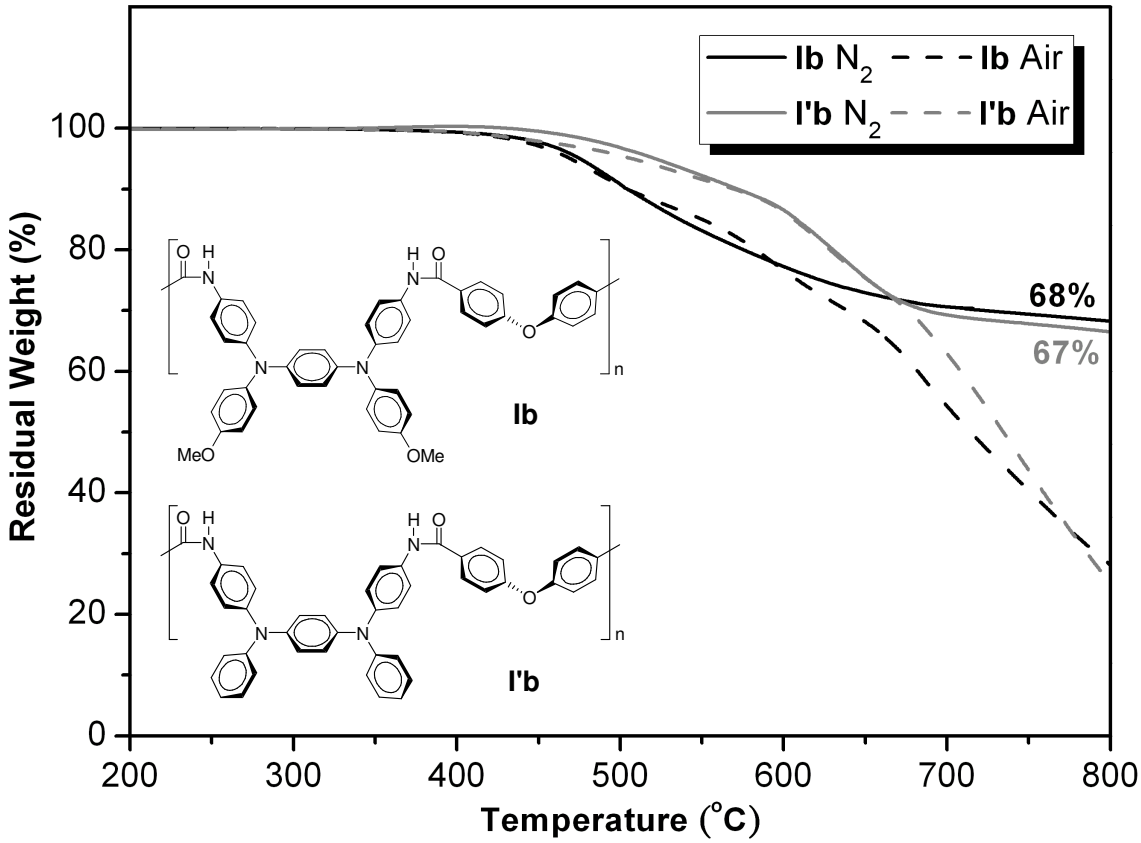


**Figure S4.** TGA thermograms of polyamides **Ib** and **I'b** at a scan rate of 20 °C/min.

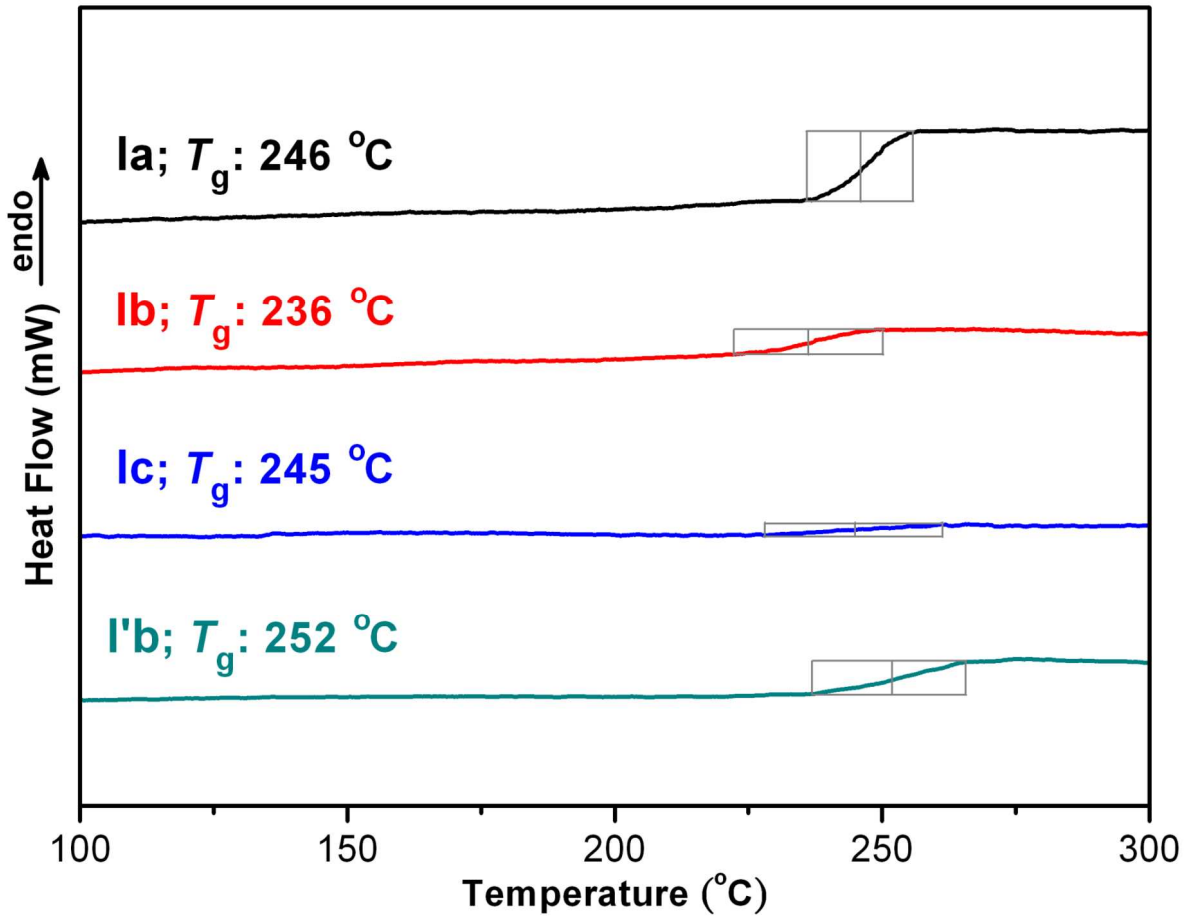


**Figure S5.** DSC traces of polyamides with a heating rate of 20 °C/min in nitrogen.