Supporting Information:

Microstructure Replication of complex biostructures via Poly(ionic liquid)-assisted Carbonization

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Section S1. Materials

All chemicals were purchased from Sigma Aldrich and used as supplied. IL monomer was synthesized by ourselves according to our previous route (Chem. Mater., 2010, 22, 5003). All solvents used were of analytic grade. Ultrapure Milli-Q water was used in all experiments. *Hoplia Coerulea* were purchased from Entemoboutique (website http://www.entomoboutique.weonea.com/#translate-en) and used as received.

Section S2. Method

PIL- Coating of the beetles via free radical polymerization.

In a typical synthesis 5 g of IL monomer was dissolved in 10 g (10.5 ml) of DMF. Eight beetles were added (total weight around 0.22 g) and gently shaken. 100 mg of AIBN (5 wt%) were added and the solution was degassed under vacuum at room temperature. After back-filling with Argon the temperature was raised to 90 °C and held for 24 hours. The excess of polymer was easily removed by dissolution in methanol (50 ml) and then by wash thoroughly with DMF. Finally the beetles were dried at 60 °C for two days till constant weight.

Anion exchange of Bug@Br.

A beetle with PIL-Br grafted on its surface was immersed in an excessive salt solution in DMF (concentration: 100 g L^{-1}) for two hours. Two salts, i.e. lithium bis(trifluoromethanesulfonyl)imide (LiTFSI) and sodium dicyanamide (NaDCA) were tested. After ion exchange the beetle was washed exhaustively with DMF and finally dried at 60 °C for two days till constant weight.

Section S4. Characterization and Equipments

Combustion elemental analysis (C/H/N content) was carried out using Vario Micro setup (version 1.4.1). Thermal gravimetric analyses (TGA) were performed on a Netzsch TG209-F1 apparatus at a heating rate of 10 °C min^{-1}. FT-IR spectra were recorded on a Varian1000 FT-IR spectrometer. SEM image was obtained on a LEO 1550-Gemini instrument sputtering with platinum. Digital optical microscope Keyence VHX-Z100 was used with lenses 100 – 1000x. Gel permeation chromatography (GPC) was performed using NOVEMA-column with mixture of 80% of acetate buffer and 20% of methanol (flow rate 1.00 mL min^{-1}, PEO standards using RI detector - Optilab-DSP-Interferometric Refractometer (Wyatt-Technology).

Section S4. Supplementary results

Table S1: Combustion elemental analysis results for the uncoated bug and PIL-coated bugs.

Entry	**N** [wt%]	**H** [wt%]	**C** [wt%]
Bug	10,8	6,3	48,0
Bug@Br	11,7	5,8	41,4
Bug@TFSI	11,8	5,8	40,5
Bug@DCA	12,8	6,2	44,7

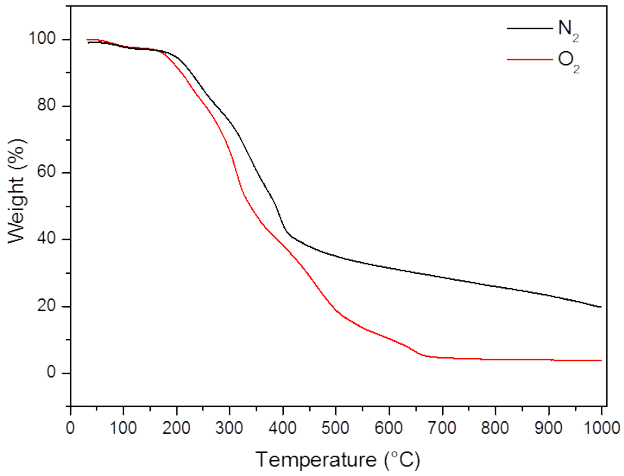

Figure S1: TGA curves of the Bug under nitrogen flow (black line) and oxygen flow (red line).

Table S2: Yields and combustion elemental analysis results for the carbonized bugs.

Entry	**Yield** [wt%]	**N** [wt%]	**H** [wt%]	**C** [wt%]
Cbug	43,6	10,8	4,9	62,0
Cbug@Br	43,2	11,0	4,3	63,2
Cbug@TFSI	44,2	11,0	4,4	62,3
Cbug@DCA	37,1	11,0	4,6	61,3

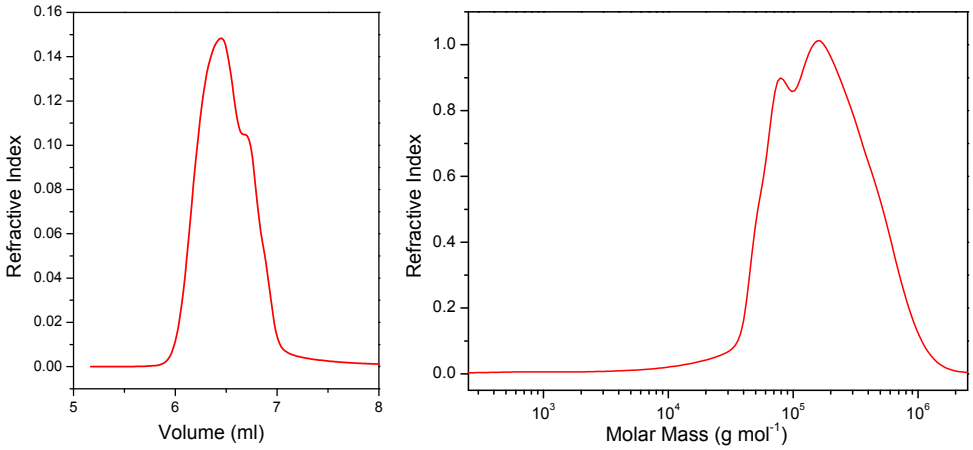

Figure S2: GPC trace and its molecualr weight distribution curve of PIL-Br, isolated from the polymerization mixture. The detected number-average molecular weight was calculated to be 55 KDa with a polydispersity index of 4. Since the PIL-Br grafted from the bug surface is impossible to measure, the isolated PIL-Br was used to estimate the PIL-Br polymer on Bug surface.