Supporting Information

Dispersion of carbon nanotubes in water with the aid of very small amount of ionic liquid

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1. Experimental Section

Materials. Commercially available multi-walled CNTs (purity ≥95%, length of 5-15 μm, diameter of 10-30 nm, special surface area of 40-300 m^2/g, CVD method) were purchased from Shenzhen Nanotech Port Co. Ltd. 2-Bromoethylamine hydrobromide was obtained from Shanghai Nanxiang Reagent Co. Ltd. N-methylimidazolium was produced by Linhai Kaile Chemical Factory, and distilled prior to use. 3-Chloro-1-propanol provided by Zouping Mingxing Chemical Co. Ltd was purified by distillation. N,N-diethylethylenediamine and 2-bromoethanol were purchased from Alfa Aesar and used as received. Other chemicals (A. R. grade) were supplied by Beijing Chemical Reagent Company.

Synthesis of 1-aminoethyl-3-methylimidazolium bromide [C_2NH_2mim][Br]: 1-aminoethyl-3-methylimidazolium bromide hydrobromide (Scheme S1) was synthesized according to the literature procedure.[1] In the experiment, freshly distilled N-methylimidazolium (30.4 g, 0.37 mol) and acetonitrile (250 ml) were added to a three-necked flask in an oil bath. The mixture was heated at 75 °C under argon atmosphere. 2-Bromoethylamine hydrobromide (38.9 g, 0.19 mol) was added to the flask in portions. The solution was heated for 24 h, and then cooled to room temperature. The top liquid was decanted and the bottom solid was washed three times with anhydrous ethanol. The resulting white solid was dried under vacuum at 70 °C overnight to afford 1-aminoethyl-3-methylimidazolium bromide hydrobromide 30.0 g.

One-necked flask of 500 ml was charged with 24.2 g (1 equiv) of powdered 1-aminoethyl-3-methylimidazolium bromide hydrobromide, 4.7 g of (1 equiv) potassium hydroxide and 250 ml of anhydrous methanol. The reaction mixture was stirred at room temperature for 5 h affording a heterogeneous mixture. The solid KBr formed was removed by filtration. Methanol and water were removed from the filtrate under reduced pressure at 70 °C. The resulting mixture was filtrated and the IL [C_2NH_2mim][Br] (Scheme S1) was collected and dried under vacuum at 70 °C for three days.

[C_2NH_2mim][Br]: ^{1}H NMR (400MHz, D_2O) $\delta = 3.12$ (t, J (H, H) = 5.9 Hz, 2H), 3.90 (s, 3H), 4.28 (t, J (H, H) = 5.9 Hz, 2H), 7.46 (s, 1H), 7.51 (s, 1H), 8.76 (s, 1H). ^{13}C-NMR (100MHz, D_2O) $\delta = 36.1$, 40.5, 51.2, 122.4, 124.2, 136.4.

Synthesis of 1-(2-aminoethyl) pyridinium bromide [C_2NH_2py][Br]: The synthesis of 1-Aminoethyl pyridinium bromide hydrobromide (Scheme S1) was performed with similar procedures with 1-aminoethyl-3-methylimidazolium bromide hydrobromide.[1]

One-necked flask of 250 ml was charged with 13.7 g (1 equiv) of powdered 1-aminoethyl pyridinium bromide hydrobromide, 2.7 g (1 equiv) of potassium hydroxide and 35 ml of water. The reaction mixture was stirred at room temperature for 2 h, and then the water was evaporated under reduced pressure at 70 ^{o}C. The IL [C_2NH_2py][Br] (Scheme S1) was extracted from the resulting mixture by using ethanol-dichloromethane. Finally, the mixed solvent was removed under reduced pressure and then the obtained IL [C_2NH_2py][Br] was dried under vacuum for 24 hours at 70 ^{o}C.

[C_2NH_2py][Br]: ^{1}H NMR (400 MHz, D_2O) $\delta =3.27$ (t, J (H, H) = 6.0 Hz, 2H), 4.68 (t, J (H, H) = 6.0 Hz, 2H), 8.11 (t, J (H, H) = 7.0 Hz, 2H), 8.58 (t, J (H, H) = 7.9 Hz, 1H),8.87 (d, J (H, H) = 6.0Hz, 2H). ^{13}C-NMR (100MHz, D_2O) $\delta = 41.8$, 63.5, 128.7, 144.6, 146.0.

Synthesis of N-methylimidazolium hydrochloride [mim][Cl], N-methylimidazole hydrobromide [mim][Br] and N,N-diethylethylenediamine hydrobromide [C_2NH_2am][Br]: [mim][Cl] (Scheme S1) was synthesized by direct neutralization of aqueous N-methylimidazole solution with hydrochloric acid solution.[2] To a stirred solution of N-methylimidazole (8.211 g, 0.10 mol) in water (15 ml) cooled in an ice bath, 37% (9.854 g, 0.10 mol) hydrochloric acid solution was added drop by drop. After five hours continuous stirring, the solvent was removed under reduced pressure at 70 ^{o}C. Then the colorless viscous liquid was washed with dry ether (3×20 ml) and dried under vacuum for 24 hours at 70 ^{o}C. N-methylimidazole hydrobromide [mim][Br] and N,N-diethylethylenediamine hydrobromide [C_2NH_2am][Br] (Scheme S1) were synthesized using the same procedures except for the use of hydrobromic acid and N,N-diethylethylenediamine instead of hydrochloric acid, respectively.

[mim][Cl]: ^{1}H NMR (400 MHz, D_2O) $\delta = 3.91$ (s, 3H), 7.42 (s, 2H), 8.64 (s, 1H).

[mim][Br]: ^{1}H NMR (400 MHz, D_2O) $\delta = 3.92$ (s, 3H), 7.43 (s, 2H), 8.66 (s, 1H).

[C_2NH_2am][Br]: ^{1}H NMR (400 MHz, D_2O) $\delta = 1.23$ (t, J (H, H) = 7.3 Hz, 6H), 3.09 (q, J (H, H) =7.3, 4H), 3.11-3.18 (m, 4H). ^{13}C-NMR (100MHz, D_2O) $\delta = 8.8$, 35.0, 47.6, 50.9.

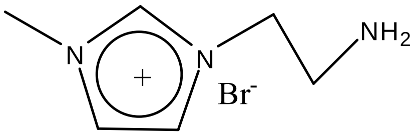
Synthesis of 1-(2-hydroxyethyl)-3-methylimidazolium chloride [C_2OHmim][Cl]: This IL (Scheme S1) was prepared according to the method reported by Branco et al.[3]

[C$_2$OHmim][Cl]: ^{1}H NMR (400 MHz, D$_2$O) δ = 3.80 (s, 3H), 3.82 (t, J (H, H) = 6.5 Hz, 2H), 4.21 (t, J (H, H) = 6.5 Hz, 2H), 7.35 (s, 1H), 7.41 (s, 1H), 8.65 (s, 1H).

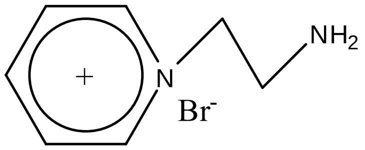
Synthesis of 1-(2-hydroxyethyl)-3-methylimidazolium bromide [C$_2$OHmim][Br]: [C$_2$OHmim][Br] (Scheme S1) was prepared according to the procedures reported by Yang and Dyson.[4]

[C$_2$OHmim][Br]: ^{1}H NMR (400 MHz, D$_2$O) δ = 3.91 (s, 3H), 3.93 (t, J (H, H) = 5.0 Hz, 2H), 4.32 (t, J (H, H) = 5.0 Hz, 2H), 7.46 (s, 1H), 7.51 (s, 1H), 8.76 (s, 1H).

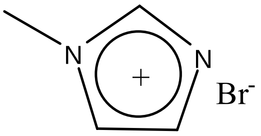
2. Structures of the ILs and the amines used



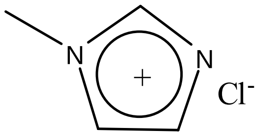
[C$_2$NH$_2$mim][Br]



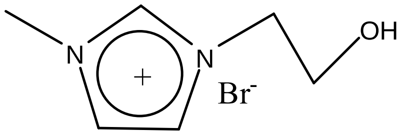
[C$_2$NH$_2$py][Br]



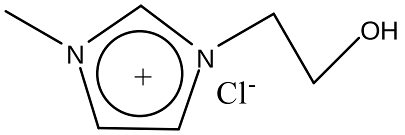
[mim][Br]



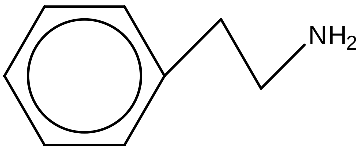
[mim][Cl]



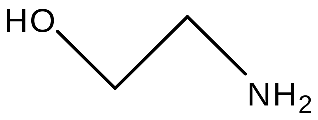
[C$_2$OHmim][Br]



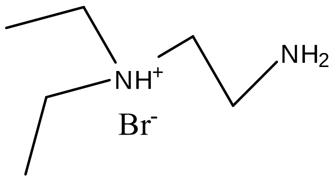
[C$_2$OHmim][Cl]



2-Phethylethylamine



Ethanolamine



[C$_2$NH$_2$am][Br]

Scheme S1. Structures of some ILs and amines used.

3. Weight percents of ILs in the CNT-IL composites.

Table S1. Weight percents of ILs in the CNT-IL composites determined by elemental analysis (EA) and XPS methods, which were calculated based on the content of N.

Samples	wt% (EA method)	wt%(XPS method)
CNT-[C_2NH_2mim][Br]	1.4	1.7
CNT-[C_2NH_2py][Br]	4.7	5.8
CNT-[mim][Br]	Negligibale	Negligibale
CNT-[mim][Cl]	Negligibale	Negligibale
CNT-[C_2OHmim][Br]	Negligibale	Negligibale
CNT-[C_2OHmim][Cl]	Negligibale	Negligibale
CNT-2-phenlethylamine	Negligibale	Negligibale
CNT-ethanolamine	Negligibale	Negligibale
[C_2NH_2am][Br]	Negligibale	Negligibale

References:

S1.Z. Zhang, Y. Xie, W. Li, S. Hu, J. Song, T. Jiang and B. Han, *Angew. Chem. Int. Ed.*, 2008, **47**, 1127.

S2. E. Janus, I. Goc-Maciejewska, M. Lozynski and J. Pernak, *Tetrahedron Letters*, 2006, **47**, 4079.

S3. L. C. Branco, J. N. Rosa, J. J. M. Ramos and C. A. M. Afonso, *Chem. Eur. J.*, 2002, **8**, 3671.

S4. X. Yang, N. Yan, Z. Fei, R. M. Crespo-Quesada, G. Laurenczy, L. Kiwi-Minsker, Y. Kou, Y. Li and P. J. Dyson, *Inorg. Chem.*, 2008, **47**, 7444.