Highly Efficient Reversible Adsorption of NO$_2$ in Imidazole Sulfonate Room Temperature Ionic Liquids

Gang Yuan, Feng Zhang, Jiao Geng* and You-Ting Wu*

Department of Chemical Engineering, School of Chemistry and Chemical Engineering, Nanjing University, Nanjing 210093, P.R. China

E-mail: gengjiao@nju.edu.cn; ytwu@nju.edu.cn

Materials and General Methods

The imidazole sulfonate room temperature ionic liquids including 1-ethyl-3-methylimidazolium trifluoromethanesulfonate ([EMIM]OTF), 1-butyl-3-methylimidazolium trifluoromethanesulfonate ([BMIM]OTF), and 1-hexyl-3-methylimidazolium trifloromethanesulfonate ([HMIM]O-TF) were purcased from Shanghai Cheng Jie Chemical Co. Ltd. (China), with the purity of above 99% and dried under vacumm at 70 ºC for 24 h to remove possible traces of water prior to use; The NO$_2$ with the purity of above 99.5% was purcased from Nanjing Tong Guang Special Gas Co. Ltd. (China). The UV-vis spectra were recorded on a UV-3600 UV-Vis-NIR Spectrometer (Shimadzu, Japan). The FTIR spectra were recorded on a Nicolet iS10 instrument (Nicolet, USA). The photographs were taken with a DSC-TX100 camera (Sony, Japan). The absorption facilities were purcased from Jiangsu
Haian Petroleum Scientific Instrument Co. Ltd. (China). The pressure data were recorded with a WIDEPLUS-8 pressure sensor purchased from Fujian Shangrun Precision Instrument Co. Ltd. (China). The temperature was controlled by a CKW-1 heating instrument purchased from Nanjing Chaoyang Instruments Co. Ltd. (China).

**Adsorption and Desorption of NO₂**

By absorbing NO₂, two kettles were connected together with a valve and immersed in a water bath of desirable temperature. A vacuum pump was connected to the kettles to control the pressure of the system, and a pressure sensor with the accuracy of 0.001 MPa was used to show and record the pressure data during the adsorption-desorption processes. NO₂ was released to the surface of ILs contained in a glass container with an inner diameter of 2.5 cm, and the initial pressure was recorded by the pressure sensor. With the help of magnetic stirring, the NO₂ was automatically absorbed by the ILs and the pressure changes were recorded. After the absorbing equilibrium was achieved, the connected kettles were evacuated so that the NO₂ could be released rapidly. Then the next round of absorption-desorption was conducted by using the same method.
Fig. S1 UV-vis spectra of [Emim]OTF (a) and [Bmim]OTf (b), before (dashed lines) and after (solid lines) absorption of NO$_2$. 
Fig. S2 FTIR spectra of [Emim]OTf (a), [Bmim]OTf (b), and [Hmim]OTf, before (blue lines) and after (red lines) absorption of NO₂
**Fig. S3** The relationship between the pressure changes during the absorption of NO$_2$ in different ILs (left corner) and the initial pressures of NO$_2$ ($P_0$).
Fig. S4 The real-time system pressures ($P$) during the absorption of NO$_2$ in [Emim]OTf (a), [Bmim]OTf (b), and [Hmim]OTf, at the different temperatures (right corners).