Electronic supplementary information

Chemical Activation of Boron Nitride Fibers for Improved Cationic Dye Removal Performance

Jie Li [a,b], Yang Huang [a,b], Zhenya Liu [a,b], Jun Zhang [a,b,*], Xiaoxi Liu [a,b], Han Luo [a,b], Yuanhui Ma [a,b], Xuewen Xu [a,b], Yang Lu [a,b], Jing Lin [a,b,c,*], Jin Zou [c,d], Chengchun Tang [a,b,*]

[a] School of Materials Science and Engineering, Hebei University of Technology, Tianjin 300130, P. R. China; E-mail: (J. Z.) junnano@gmail.com; (J. L.) dr.linjing@gmail.com; (C. T.) tangcc@hebut.edu.cn; Fax: +86-22-60202660; Tel: +86-22-60202660

[b] Hebei Key Laboratory of Boron Nitride Micro and Nano Materials, Tianjin 300130, P.R. China

[c] Materials Engineering, The University of Queensland, QLD 4072, Australia
[d] Centre for Microscopy and Microanalysis, The University of Queensland, St Lucia, QLD 4072, Australia

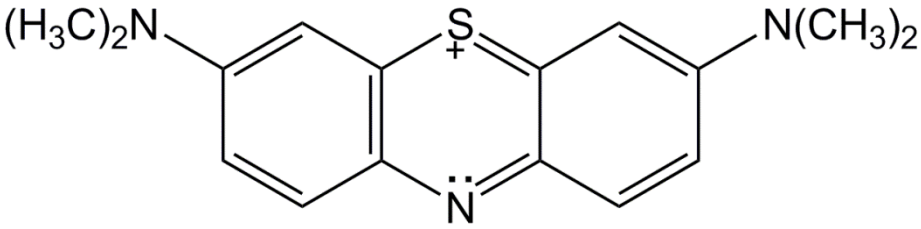

Figure S1. Structure of Methylene blue.

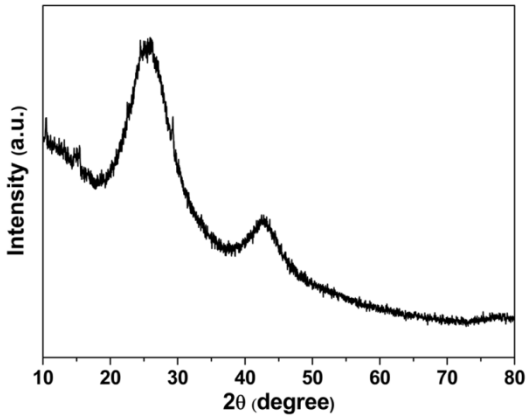

Figure S2. XRD pattern of the activated BN obtaining by the introduction of P123

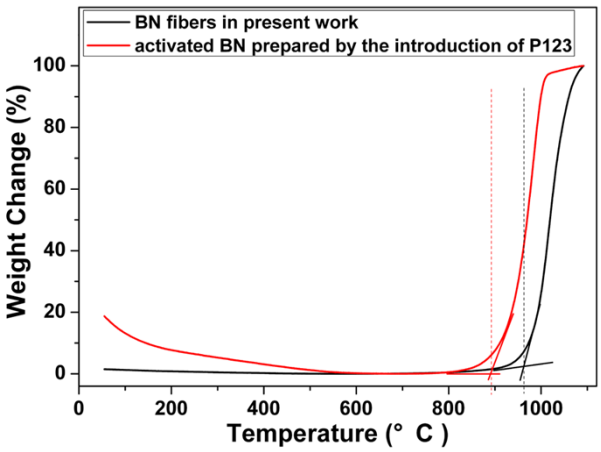

Figure S3. Thermogravimetry (TG) curves of the present chemical activated BN fibers (black) and the activated BN prepared by the introduction of P123 (red) performed in an air flow, respectively. Temperature: 1100 °C; step: 10 °C /min.

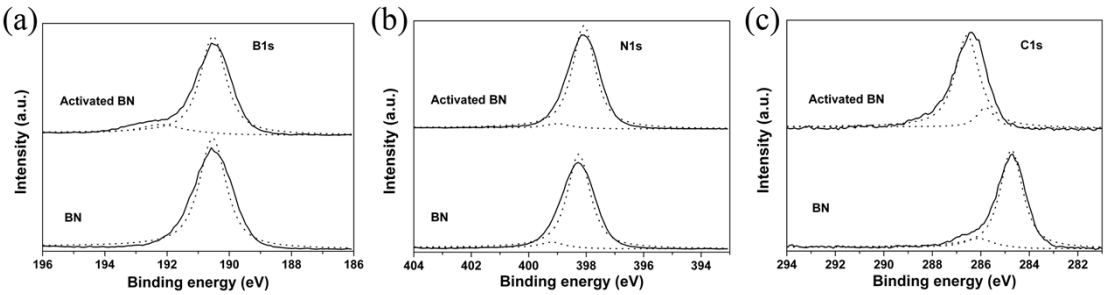

Figure S4. X-ray photoelectron spectroscopy (XPS) spectra of the activated BN and the non-activated BN fibers, (a) B1s, (b) N1s, and (c) C1s, respectively.

To further investigate the local structure of the as-obtained materials, the chemical states of B, C, and N elements were measure using XPS spectra. Figure S4 a-c display the XPS spectra of B1s, N1s, and C1s core level electrons for the activated BN and the BN fibers, respectively. The B1s spectra in Figure S4a can be fitted by Gaussian curves profile with binding energy peaks at 190.3, 190.2, 192.5 and 192.3 eV. The main peaks centered at 190.3 and 190.2 eV are attributable to the typical layer BN, and the peaks at 192.5 and 192.3 eV could be due to the presence of B-O bonds[1]. It should be noted that the slightly higher value of the B1s peaks at 192.5 and 192.3 eV may be ascribed to the more oxygen merging into the oxidation sensitive boron atom sites. The N1s spectra in figure S4b can be fitted by Gaussian profiles: the main peaks (~ 398.3 eV) are attributed to the sp^2 N-B bonding and the other peaks centered at about 399.4 eV refers to the N-C bonding.[2] The C1s spectra in figure S4c is well fitting by different curves: the main peaks centered at 284.5 eV corresponds to the C-C bonding in graphite, indicating that some graphitic domains exist in the BN fibers originates from the decomposition of the melamine. The shoulders at 286.2 and 286.4

eV correspond to C-N and C-O,[3] respectively, suggesting that the carbon is oxidized by the mixed solution of dense sulfuric acid and nitric acid.

List of tables:

Table S1. Dye properties.

Dye name	Molecular formula	Molecular weigh (g/mol)	Maximum absorption (nm)
Methylene blue	$C_{16}H_{18}N_3N_3SCl$	319.85	663

Table S2 Langmuir and Freundlich parameters for MB adsorption onto activated BN and BN fibers.

Langmuir model				Freundich model		
Adsorbent	Q_m (mg/g)	K_L (L/mg)	R^2	K_F	n	R^2
Activated BN	392.2	3.51	0.998	295.3	9.18	0.916
BN fibers	243.2	0.68	0.993	40.8	1.73	0.92

Table S3. Variations in the elemental contents on both samples

Samples	Nitrogen (wt %)	Oxygen (wt %)	Carbon (wt %)	Boron (wt %)
Activated BN	50.84	8.55	0.16	40.01
BN fibers	53.8	3.1	0.49	42.5

1. Pakdel, A.; Wang, X.; Zhi, C.; Bando, Y.; Watanabe, K.; Sekiguchi, T.; Nakayama, T.; Golberg, D., Facile synthesis of vertically aligned hexagonal boron nitride nanosheets hybridized with graphitic domains. *J. Mater. Chem.* **2012,** *22* (11), 4818-4824.

2. Raidongia, K.; Nag, A.; Hembram, K. P. S. S.; Waghmare, U. V.; Datta, R.; Rao, C. N. R., BCN: A Graphene Analogue with Remarkable Adsorptive Properties. *Chem.-Eur. J.* **2010,** *16* (1), 149-157.

3. (a) Niwa, Y.; Kobayashi, H.; Tsuchiya, T., X‐ray photoelectron spectroscopy of tetraphenylporphin and phthalocyanine. *The Journal of Chemical Physics* **1974,** *60* (3), 799-807; (b) Wang, Y.; Shao, Y.; Matson, D. W.; Li, J.; Lin, Y., Nitrogen-Doped Graphene and Its Application in Electrochemical Biosensing. *ACS Nano* **2010,** *4* (4), 1790-1798.