

Supplemental Material

Facile one-pot synthesis of bimodal mesoporous carbon nitride and its function as a lipase immobilization support

Wenzhong Shen,^{*a} Liwei Ren,^b Hua Zhou,^b Shouchun Zhang^a and Weibin Fan^{*a}

^a Key Laboratory of Carbon Materials, Institute of Coal Chemistry, Chinese Academy of Sciences, Taiyuan, Shanxi 030001, PR China. Fax: (+86)351-4041153;

E-mail: shenwzh2000@yahoo.com, wbfan@sxicc.ac.cn

^b Nanjing University of Technology

Nanjing, Jiangsu, 210009, PR China. E-mail: zhouhua@sina.com

Catalytic efficiency

Catalytic efficiency was defined as the activity of unit enzyme that immobilized on the support, i.e. the ratio of total activity of lipase to the total immobilized lipase amount. The related activity was defined as the ratio of Catalytic efficiency to the rude enzyme activity, the computational formula as following:

$$Ce = \frac{A}{(Ci - Cf) \times Vi - Cw \times Vw}$$

$$R' = \frac{Ce}{a} \times 100$$

Ce: Catalytic efficiency; A: the total activity of immobilized CRL; *Ci*、*Cf* and *Cw* were the concentration of CRL in initial solution, residual solution and leaching solution, respectively; *Vi* and *Vw* were the volume of initial solution leaching solution; “a” was the activity of rude CRL.

Effect of pH on CRL catalytic activity

The effect of pH on the hydrolysis of *Triester Hydrolysis Catalysis Reactions* was investigated for the aqueous phase pH values of 5, 6, 7 and 8 at 38 °C temperature. The pH of the aqueous phase of the hydrolysis medium was adjusted with phosphate buffer. Although the highest amount of protein was adsorbed at pH 6, CRL

immobilized at pH 5 exhibited higher activity.

Table 1 Specific activity of immobilized CRLs at CN-600 and SBA-15

pH	CRL@CN-600	CRL@SBA-15
	Specific activity (U/mg)	Specific activity (U/mg)
5	935	902.5
6	837	831.0
7	837	851.5
8	790	784.0

UV-Vis spectra of carbon nitride

UV-Vis spectra were recorded using a Cary 500 Scan UV-Vis NIR spectrophotometer (VARIAN) and were shown in figure 1s.

There were two adsorption bands at 248 nm and 220 nm, which could be attributed to the benzene ring characteristic adsorption bands of B and E2, its strength decreased with the carbonization temperature.

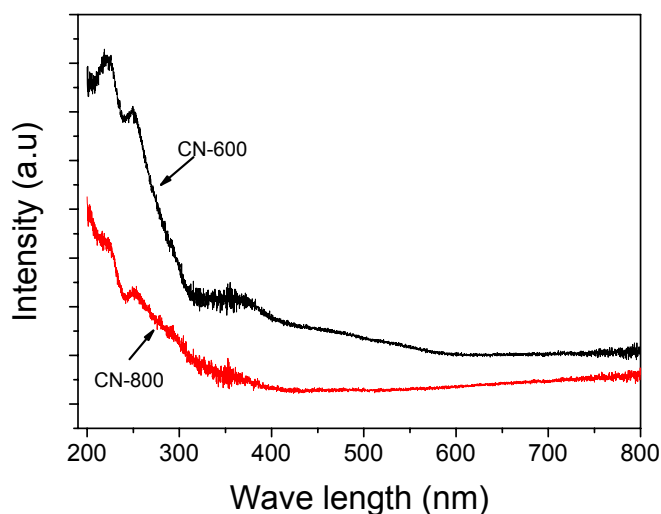


Figure 1s. UV-Vis spectra of CN-600 and CN-800.

TEM image of CN-600

Transmission electron microscopy (TEM) images were recorded on a JEM-2100F micro-cope (JEOL, Japan) operated at 200 kV. Before TEM measurements, the samples were dispersed in ethanol.

Suspensions of the samples were dropped onto a holey carbon coated copper grid. The TEM image of CN-600 was shown in figure 2.

TEM images (Figs. 3(a)–3(c)) of the spherical silica MCF templates and mesoporous CN replicas show that the foam-like mesostructures are well replicated. In addition to some pores (Fig. 3(b)) arising from the original pores of the silica template, the spherical mesoporous CN replicas also contain some “sphere-like” particles, suggesting a faithful replication of the template.

Furthermore, some small mesopores of diameter ca. 4 nm can also be observed (Fig. 3(c)), which result from the removal of the silica pore walls. These results are consistent with the nitrogen sorption and SEM results. The HRTEM images and corresponding SAED pattern (Fig. 3(d) and Fig. S-2 in the ESM) demonstrate that the pore walls have a partly graphitized and glass-carbon-like structure.

Transmission electron microscopy (TEM) images were recorded on a JEM-2100F microscope (JEOL, Japan) operated at 200 kV. Before TEM measurements, the samples were dispersed in ethanol. Suspensions of the samples were dropped onto a holey carbon coated copper grid. The TEM image of CN-T-600 was shown in figure 2S.

It can be seen there exist larger mesopore among the particles, while the less mesopore was distributed in the particles and connected with the larger mesopore, so, it is benefit the mass transporting.

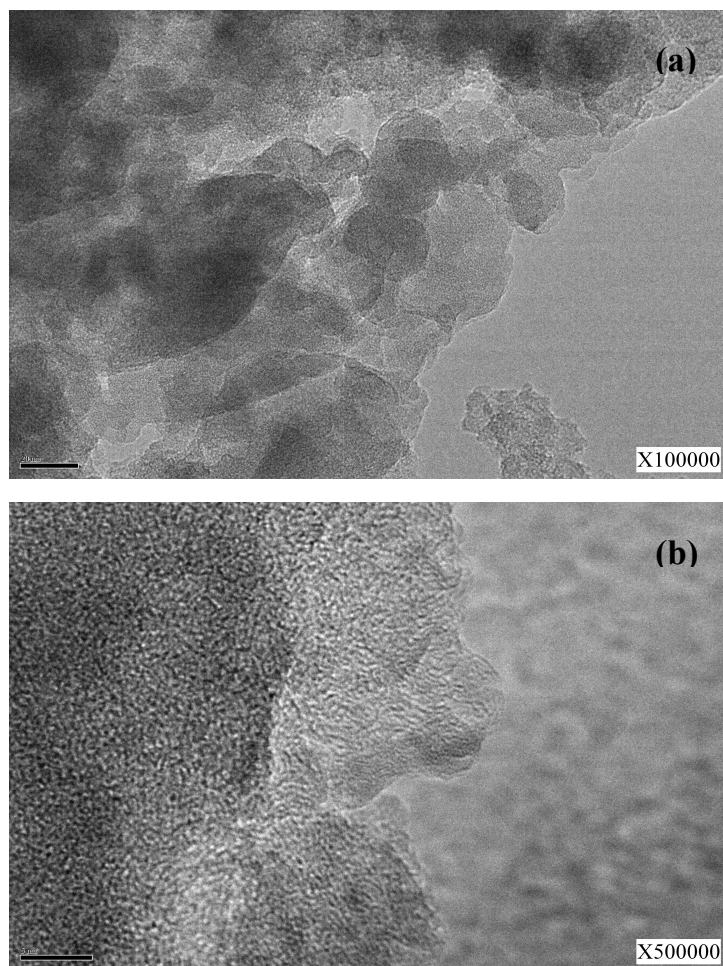


Figure S2. the TEM image of CN-T-600.