Electronic Supplementary Information (ESI)

Molecularly Imprinted Polymer-Coated Silicon Nanowires for Protein Specific Recognition and Fast Separation

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1. TEM, IR, XPS and TGA characterization

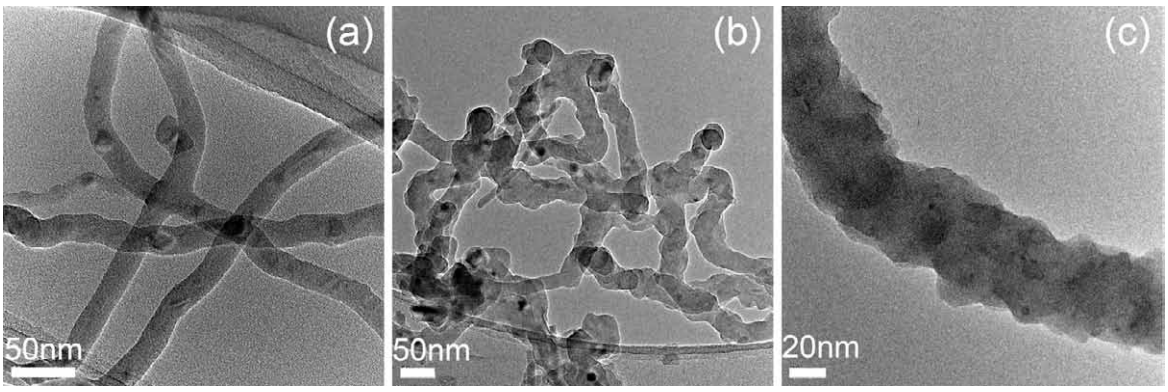

Figure S1. TEM images of SiNWs and BHb-imprinted nanowires. (a) SiNWs; (b, c) BHb-imprinted nanowires.

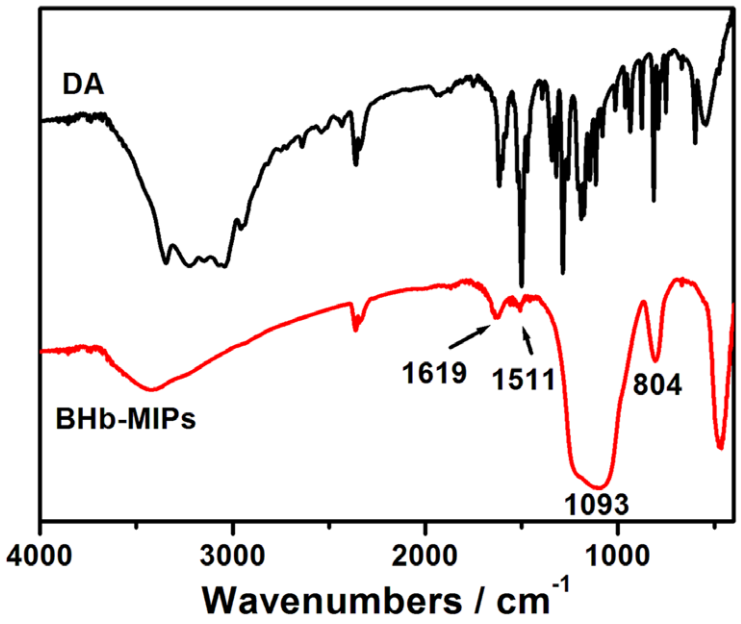

Figure S2. FT-IR spectra of the BHb-imprinted nanowires and DA

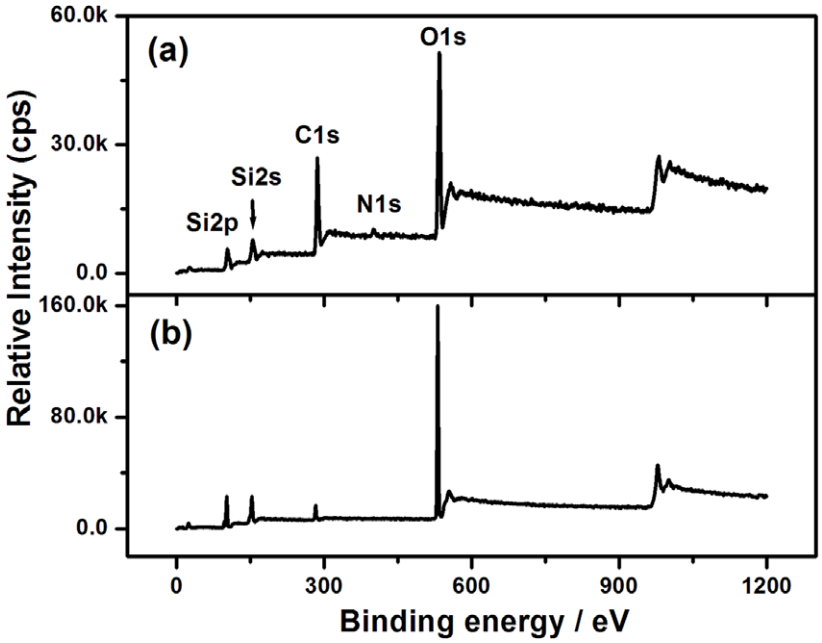

Figure S3. XPS wide-scan spectra of the (a) BHb-imprinted nanowires, (b) SiNWs

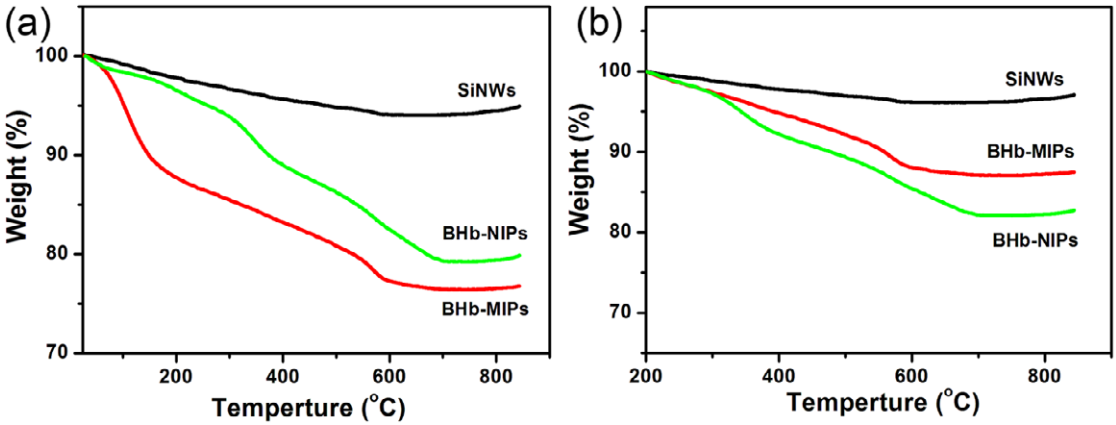

Figure S4. TGA curves for SiNWs, BHb-imprinted nanowires and non-imprinted nanowires started at (a) room temperature, and (b) 200 ºC.

The weight loss before 200 ^{o}C can be ascribed to the evaporation of water molecules. So the higher weight loss for MIPs at 200 ^{o}C was probably due to that the samples were not sufficiently dried before the measurement. When analyzing the polymer amount grafted, the weight loss before at 200 ^{o}C should be subtracted. It can be found that both BHb-MIPs and NIPs show more weight loss than the SiNWs upon heated to 850 ^{o}C, which indicates that there were thin polymer coatings outside the SiNWs.

2. Small-angle X-ray scattering (SAXS) analysis

The intensity profiles were output as the plot of scattering intensity (I) versus scattering vector, $q = 4\pi \sin\theta / \lambda$ ($\lambda = 0.124$ nm, wavelength; 2θ = scattering angle).

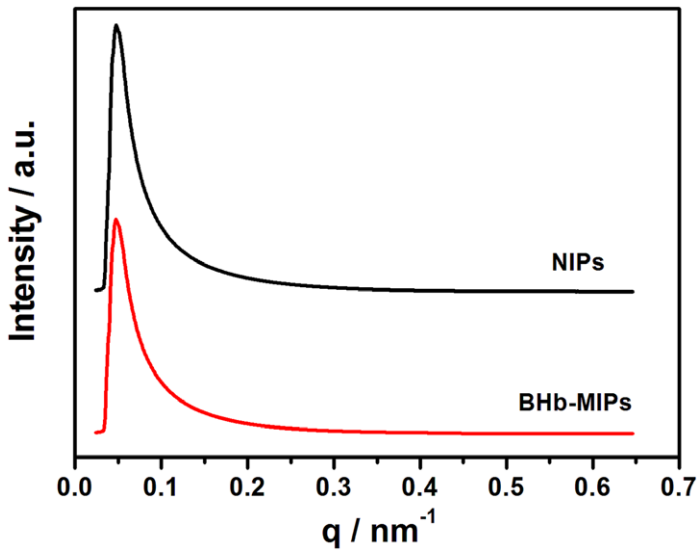

Figure S5. SAXS profiles of non-imprinted nanowires and BHb-imprinted nanowires

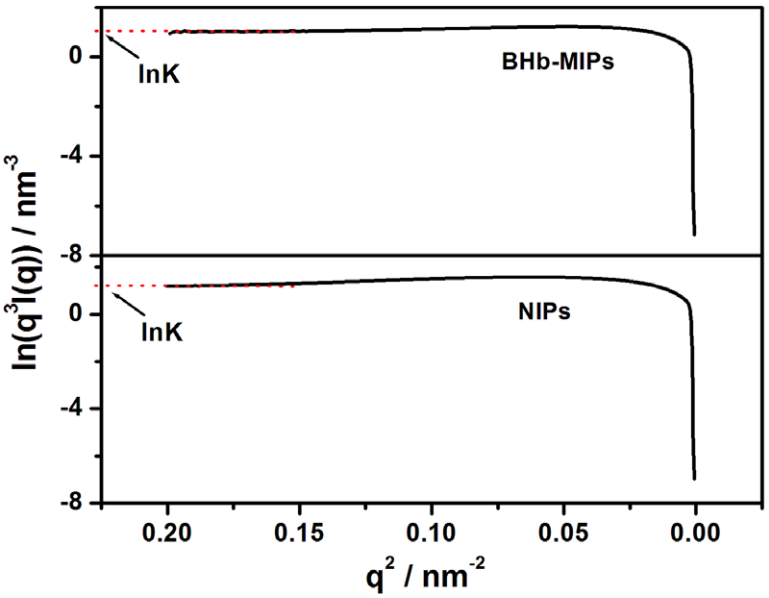

Figure S6. SAXS data plotted as $\ln[q^3 I(q)]$ versus q^2 for non-imprinted nanowires and BHb-imprinted nanowires.

The specific surface area can be calculated from the Porod's law:[S1,S2]

$$S_p = 4000P(1-P)\frac{K}{Q} \quad (1)$$

$$\lim_{q\to\infty} \ln[q^3 I 9q)] = \ln K \quad (2)$$

$$Q = \int_0^\infty qI(q)dq \quad (3)$$

where S_p (m^2/cm^3) is the specific surface area, P is the volume fraction of the pores, K is the Porod constant. When $\ln[q^3 I(q)]$ is plotted versus q^2, the slope at high values of the scattering vector is expected to be zero. This is a kind of an asymptotic behavior of the scattering of an ideal two-phase system.

Table S1. The results of SAXS

Sample	P	K	$S_p(m^2/cm^3)$
BHb-MIPs	0.356	3.11	66.72
NIPs	0.087	3.57	19.73

3. Scatchard analysis

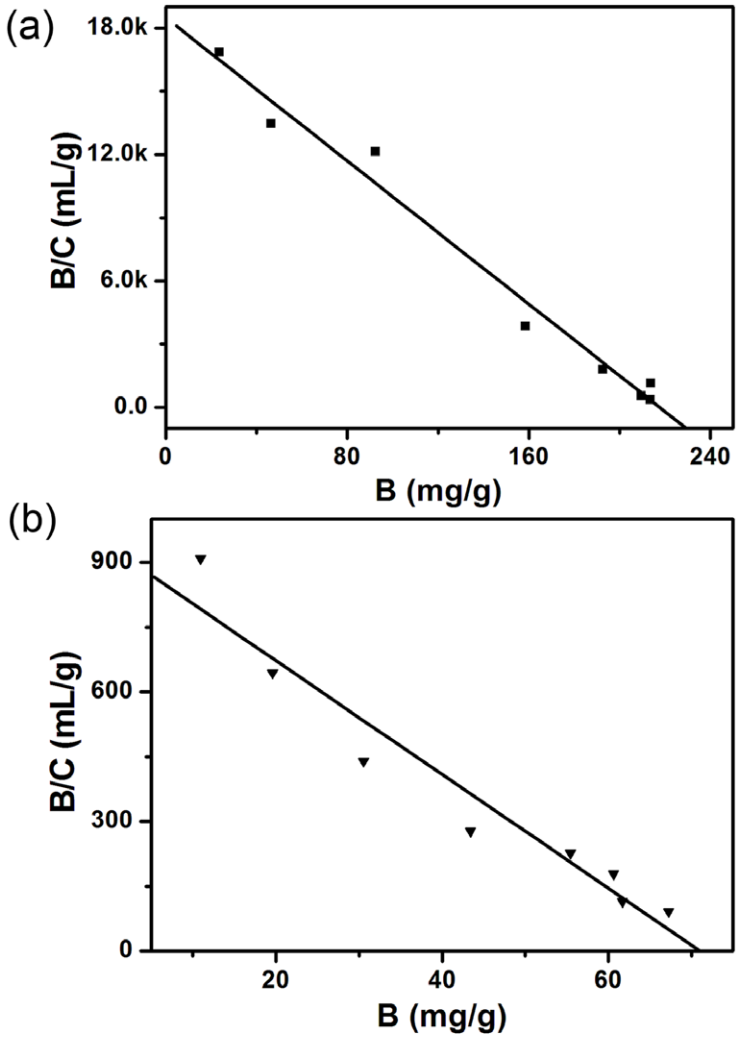

Figure S7. Scatchard plot for BHb binding to (a) BHb-MIPs and (b) NIPs.

4. Comparison with previous reports

Table S2. Comparison of the maximum binding capacity (*Q*max) with some reported works for imprinting protein.

	*Q*max(mg/g)	Supported material
Our work	213.74	SiNWs
Li et al., 2006[S3]	27.2	AAO membrane[a]
Zhang et al., 2010[S4]	5.53	multiwalled carbon nanotubes
Kan et al., 2010[S5]	10.52	Fe_3O_4 particles
Qin et al., 2009[S6]	181.0	hydrogel
He et al., 2010[S7]	11.3	silica nanoparticles
Bonini et al., 2007[S8]	1.4	silica beads
Hua et al., 2009[S9]	27.3	silica microspheres

[a]AAO: anodic alumina oxide

5. Competitive binding experiments

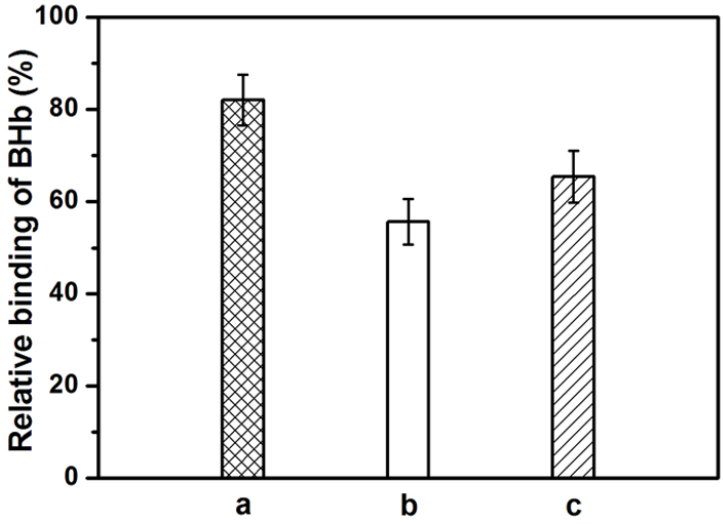

Figure S8. Competitive binding of template BHb with nontemplate (a) BSA, (b) Lyz and (c) RNase A. The initial template and nontemplate protein concentration used for binding were 0.2 mg/mL. Amount of NIPs: 1mg/mL; Volume: typically 1.0 mL; Time: 1 h. The points represent mean values of three measurements.

Because of NIPs have no imprinted cavities; protein adsorption relies on physical adsorption. BSA possesses the same charge with NIPs, the electrostatic repulsion weakens its physical adsorption. Hence, in the presence of BSA, the relative rebinding of template proteins to NIPs reached about 82%. For Lyz, RNase and BHb, the nonspecific binding of them to NIPs is similar. So in the presence of Lyz and RNase, the relative rebinding of template proteins to NIPs only reached about 55% and 65% respectively.

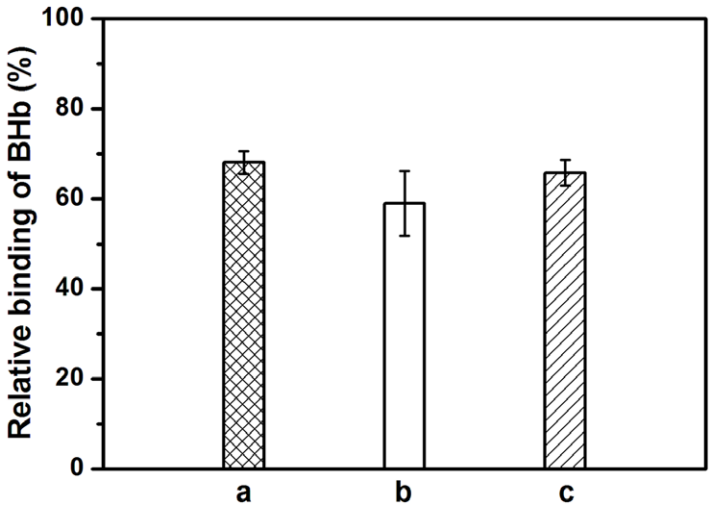

Figure S9. Competitive binding of template BHb with nontemplate (a) BSA, (b) Lyz and (c) RNase A. The initial template and nontemplate protein concentration used for binding were 0.2 mg/mL and 1mg/mL, respectively. Amount of BHb-MIPs: 1mg/mL; Volume: typically 1.0 mL; Time: 1 h. The points represent mean values of three measurements.

Reference

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