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Controllable Assemblly of Ag/C/Ni Magnetic Nanocables and Its Low Activation Energy Dehydrogenation Catalysis

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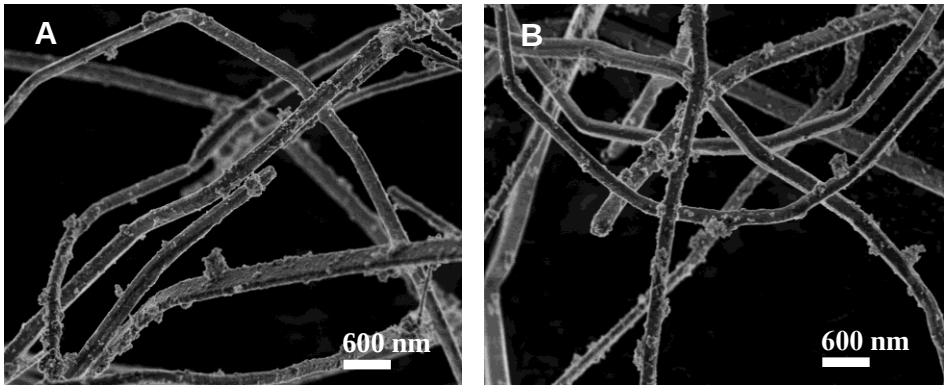

Figure S1. Low magnification SEM image of Ag/C/Ni nanocables

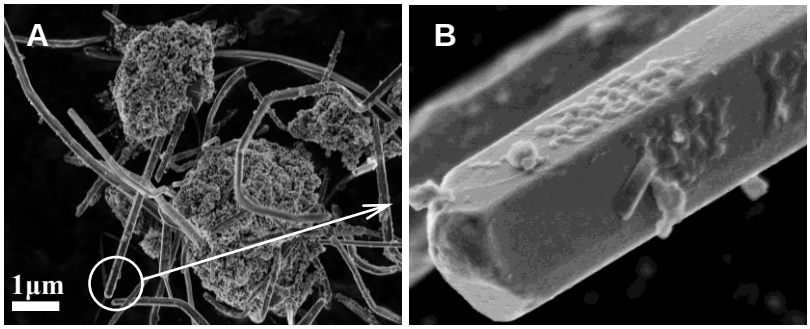

Figure S2. SEM image (A) and its high-magnification SEM image (B) of Ag/C/Ni obtained in the absent of NaOH.

As Figure S2 and the inset image show, if NaOH is absent, no Ni NPs or few amount of Ni NPs is deposited on the surface of Ag@C NWs, and the Ni NPs prefer to form agglomeration particles due to intrinsic magnetic dipole interaction.

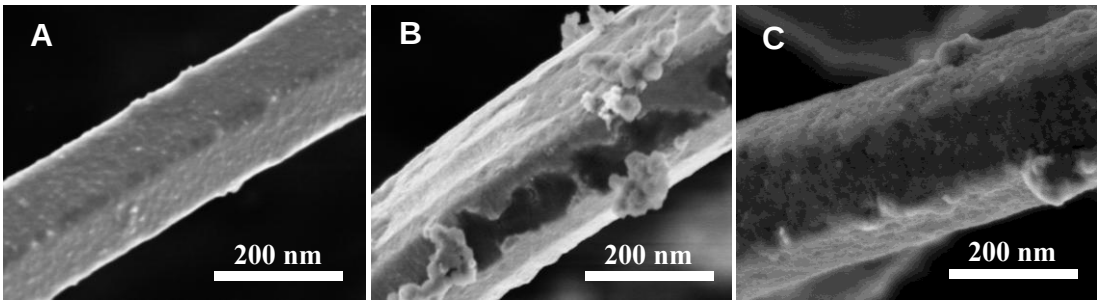

Figure S3. The SEM images obtained at reaction time of 0 min(A), 10 min (B) and 30 min (C).

Figure S3 illustrates the SEM images monitored at different reaction times for the formation of Ag/C/Ni nanocables. Only Ag/C nanowires with smooth surface can be observed in Figure S3A at the beginning of the reaction. As the reaction time prolong, partial Ni covered Ag/C nanowires along edges appear in Figure S4B, and finally results in the Ag/C/Ni double-shell nanocables in Figure S3C.

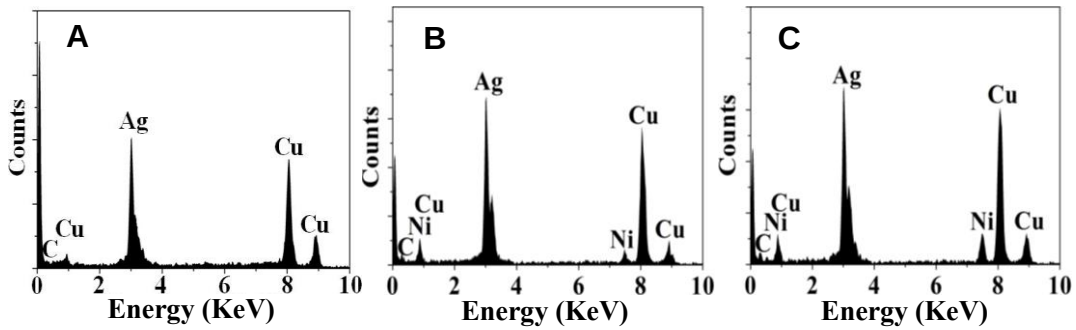

Figure S4. EDS analysis of Ag/C (A), partial (B) and full (C) Ni covered Ag/C/Ni nanocables. (Cu is from the TEM grid)

Figure S4 shows the EDS analysis for Ag/C/Ni obtained in different reaction time. Before the addition of Ni^{2+}, the EDS analysis of Ag/C (Figure S4A) only shows Ag with small amount of C. The EDS of final products show the Ag:Ni atomic ratio to be ~ 4:1, corresponding to the full Ni covered Ag/C/Ni nanocables (Figure S4C), which agree well with the target atomic ratio. The EDS for the products obtained in the earlier formation process of Ag/C/Ni nanocables reveals that the Ag:Ni atomic ratio to be ~ 8/1, indicating the partial Ni covered on the surface (Figure S4B).

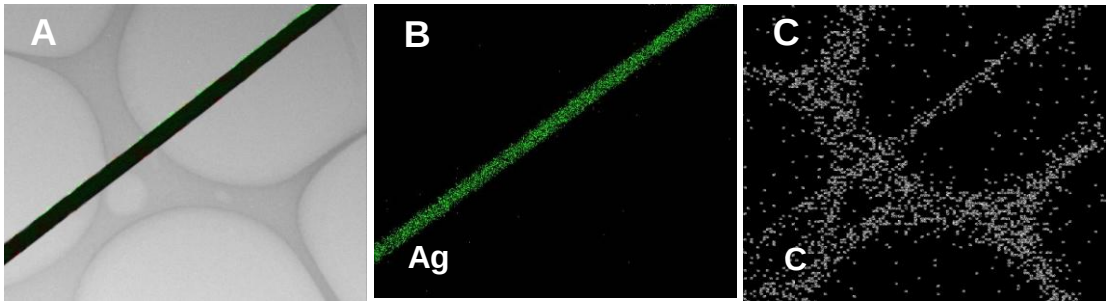

Figure S5. BF-STEM image of a single Ag/C nanowire (A) with the elemental maps for Ag (B) and C (C) (TEM Cu grid is covered by C film).

In order to clear C signal in EDX spectroscopy is from Ag/C NWs samples but not from TEM grid, a single Ag/C NW was characterized by bright field scanning TEM (BF-STEM) and shown in Figure S5. Figure S5a shows a representative STEM image. Figure S5b and Figure S5c illustrate the corresponding energy dispersive X-ray spectroscopy (EDS) maps for Ag and C element. In Figure S5c, 1D distributed C layer can be clear observed, and the other C is from TEM grid, confirming that C layer covered on the Ag NWs. Thus, the C signal in EDS in Figure 3A is both from Ag/C NWs samples and the TEM grid's contribution.

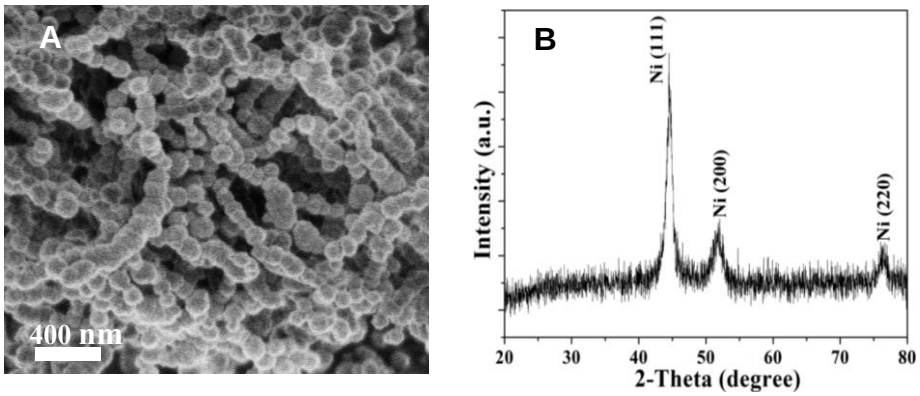

Figure S6. The SEM images (A) and XRD pattern (B) of Ni NPs.

The image in Figure S6A shows that the as-prepared products are nanoparticles with the average diameter of about 120 nm. Its XRD pattern in Figure S6B agrees well with the face-centered cubic of Ni NPs (JCPDF# 04-0850), which is indicating the formation of Ni NPs.

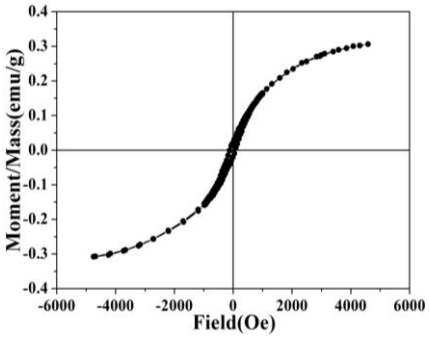

Figure S7. Magnetic hysteresis loops of Sample-b Ag/C/Ni nanocables.

In Figure S7, the *Ms* (0.31 emu·g^{-1}) and *Hc* (102.53 Oe) of Sample-b Ag/C/Ni nanocables with thin Ni shell are slightly lower than that (*Ms* at 0.53 emu·g^{-1} and *Hc* at 120.55 Oe) of Sample-a Ag/C/Ni nanocables with thick Ni shell (Figure 6A). So the magnetic behavior is affected by Ni shell thickness.

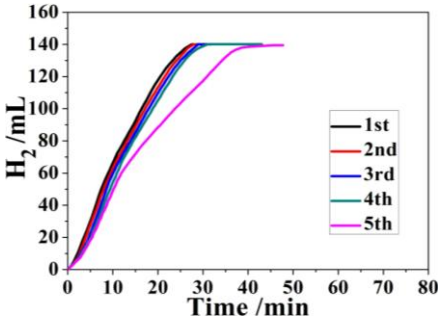

Figure S8. Hydrogen generation from above AB aqueous solution catalyzed by Sample-a Ag/C/Ni nanocables from the 1st to 5th run of the lifetime experiment under ambient atomosphere at 293 K. Catalyst/AB=0.023 (molar ratio).

Figure S8 gives the hydrogen generation from above AB aqueous solution catalyzed by Sample-a Ag/C/Ni nanocables from the 1st to 5th run of the lifetime experiment under ambient atomosphere at toom temperature. The small decrease of the catalytic activity for the Ag/C/Ni nanocables was occurred gradually over five times experiment. From the first to the fourth, the reaction time only small increased from 25min for the first time to 30 min, and the fifth time reaction process spends about 40 min. Therefore, the as-obtained Ag/C/Ni nanocables have the good lifetime and stability for the hydrolytic hydrogen generation of AB under ambient atmosphere.