Supporting Information

Highly Stable and Sensitive Paper Based Bending Sensor Using Silver Nanowires/Layered Double Hydroxides hybrids

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Synthesis of Hexagonal Co-Al LDHs

The hexagonal Co-Al LDHs was synthesized by hydrothermal process.[1] In a typical procedure, 0.003 mol $AlCl_3$ and 0.006 mol $CoCl_2 \cdot 6H_2O$ were successively dissolved in 100 mL deionized water in beaker and then excessive solid urea was dissolved in the solution. The obtained red solution was transferred into PTFE tank and sealed in a stainless cylinder and then kept at 100 ºC for 24h. After the temperature drops back to room temperature, the pink product was washed by anhydrous ethanol several times and dried at 60 ºC for 24 h.

Anion Exchange of LDHs

To exfoliate the Co-Al LDHs, the pristine Co–Al LDHs were anion exchanged with a salt-acid treatment.[2] Typically, 1.0 g as prepared LDHs sample was dispersed into 1000 mL aqueous solution contained 1.0 M NaCl and 3.3 mM HCl and stirred at 160 rpm at room temperature for 12 h under nitrogen gas. The Cl^- intercalated LDHs were obtained by centrifugation and washed by anhydrous ethanol several times and dried at 60 ºC for 24 h. After that, The 1.0 g Cl^-–LDHs were added into 1000 mL aqueous solution contains 0.05 M NaNO3 and stirred at 160 rpm at room temperature for 12 h under nitrogen gas. The $NO3^-$–LDHs sample was obtained by centrifugation and washed by anhydrous ethanol several times and then dried at 60 ºC for 24 h.

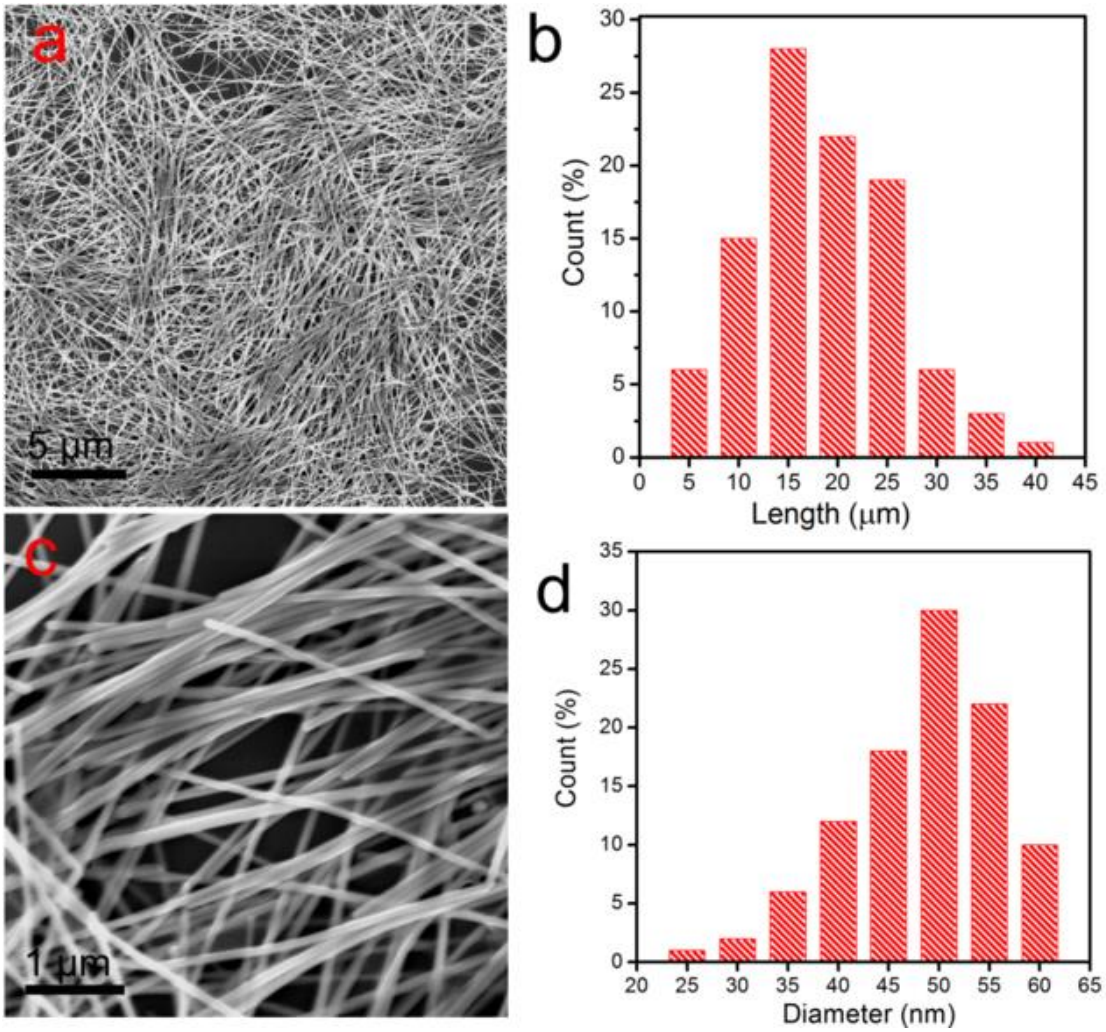

Fig.S1 FESEM images of pristine AgNWs and histogram showing length and diameter of AgNWs. (AgNWs suspension was directly deposited on glass slide by dropper and dried in air).

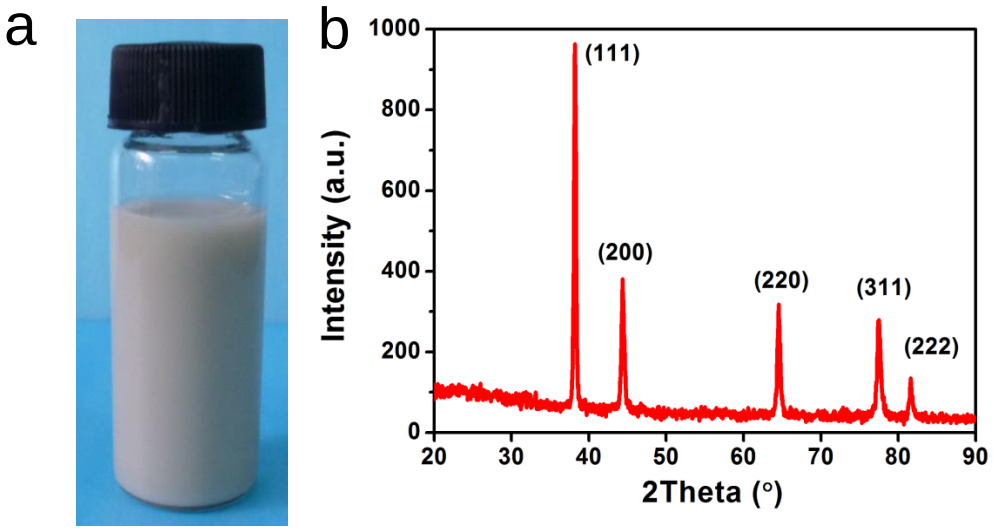

Fig.S2 (a) Digital photograph of AgNWs ethanol solution presents uniformly gray color and (b) XRD pattern of as prepared AgNWs.

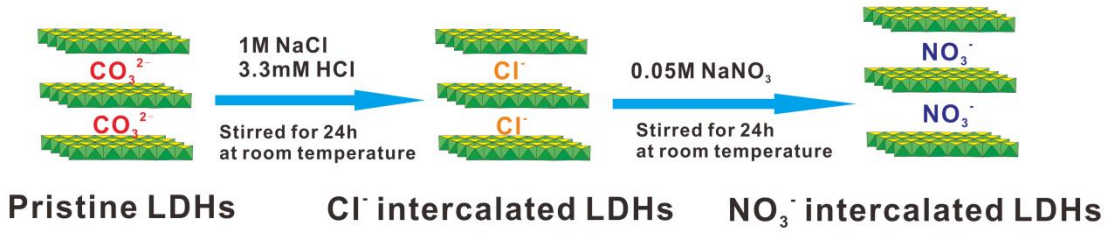

Fig.S3 Schematic illustration of anion exchange of Co-Al LDHs.

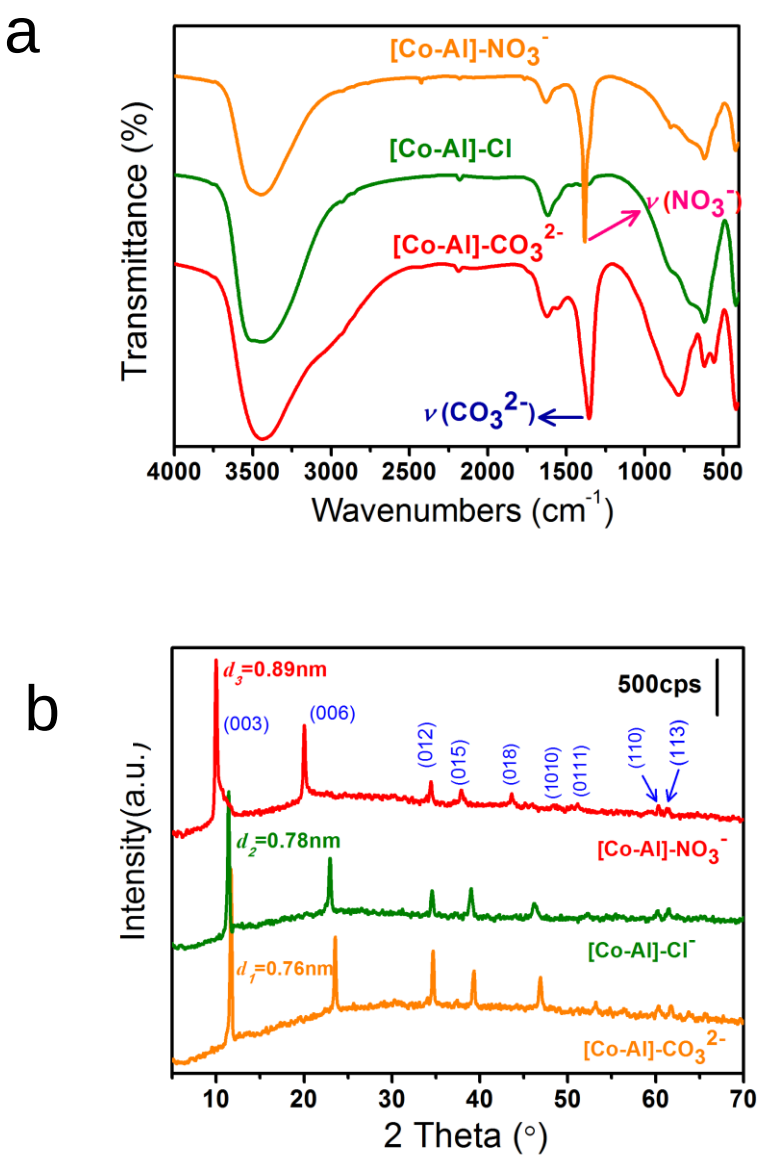

Fig.S4 FTIR (a) and XRD (b) patterns of LDHs intercalated with different anions, indicating that NO_3^- was intercalated into the interlayer of LDHs and the interlamellar spacing *d* was increased from 0.76 nm to 0.89 nm.

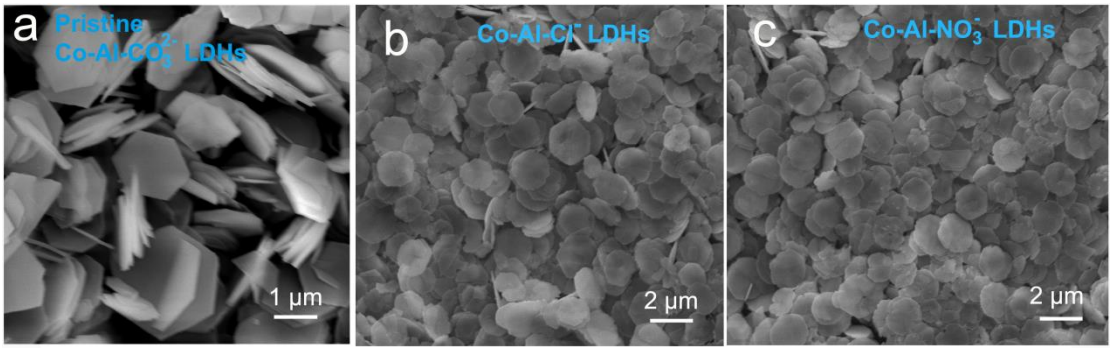

Fig.S5 FESEM images of LDHs intercalated with different anions to show the pristine and anion exchanged LDHs have the same morphology.

Fig.S6 Obvious Tyndall effect is observed for Co-Al LDH nanosheets colloidal suspension, which has an outstanding stability of more than 6 months without any sediment.

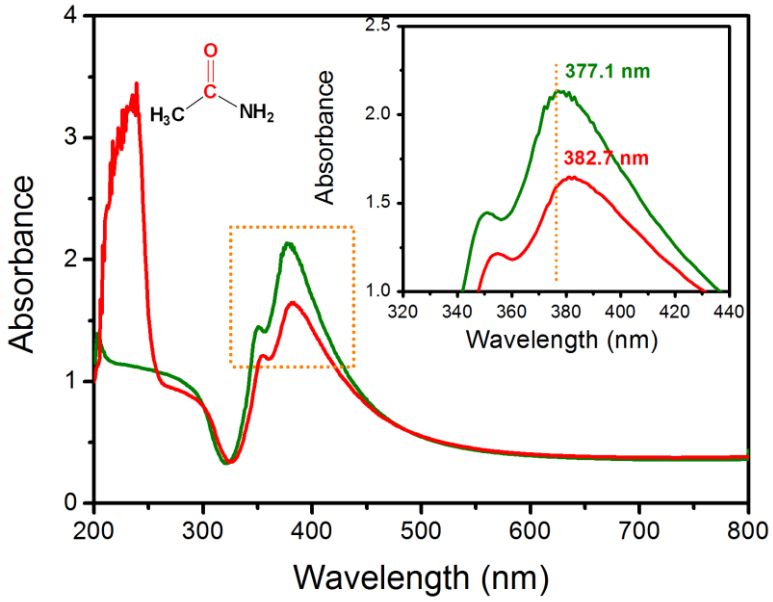

Fig.S7 UV-vis spectrums of pristine AgNWs and AgNWs/LDH nanosheets hybrids.

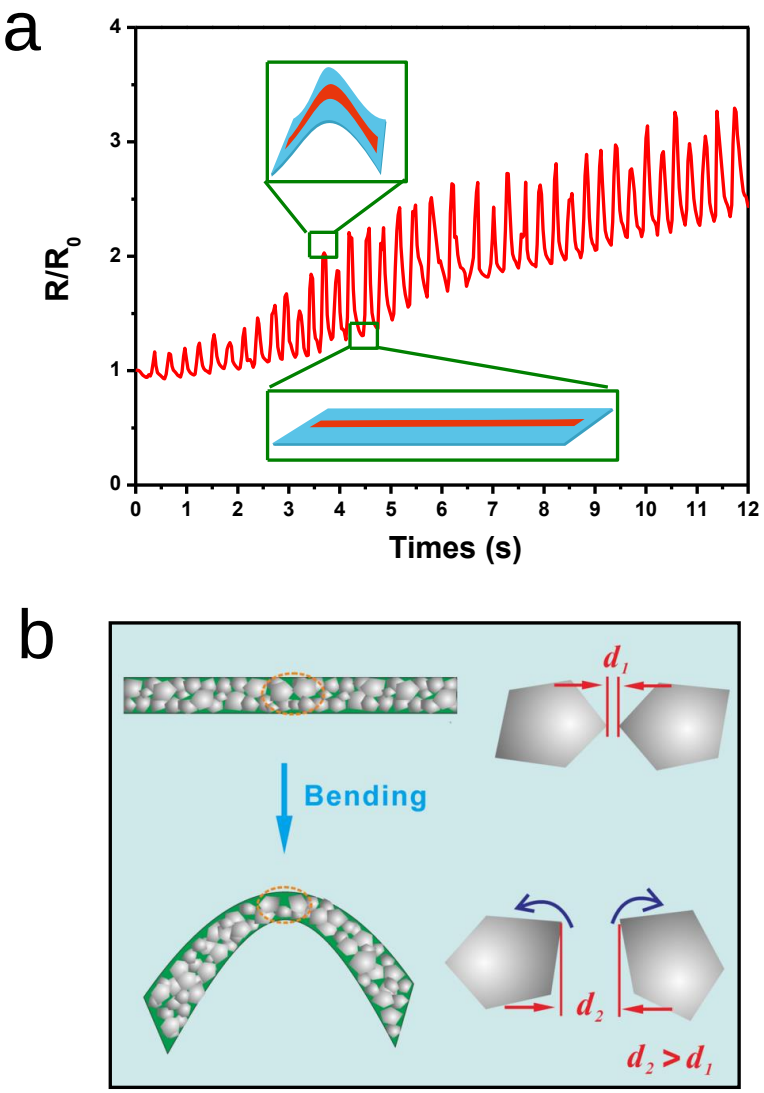

Fig.S8 (a) Responses of the composites incorporated with silver flakes (the mass ratio of silver flake is 70 wt%, and the bending performance is tested under frequency of 4 Hz. (b) Schematic for the behavior of the composites filled with micro-sized fillers.

Table S1 Volume resistivity of the composites filled with the hybrids and AgNWs only (for the composite incorporated with the hybrids, the mass ratio of AgNWs and LDH nanosheets was kept at 4:1).

Filled with the hybrids			**Filled with AgNWs only**		
Contents of AgNWs (vol%/wt%)	**Resistivity (Ω·cm)**	**Error(±)**	**Contents of AgNWs (vol%/wt%)**	**Resistivity (Ω·cm)**	**Error(±)**
1.7/14.5	23260	6290	7.5/45	33505	7945
2.4/19.0	8910	2280	9.0/50	13451	3400
◆ **3.1/23.8**	**206**	**38**	◆ **10.8/55**	**902**	**400**
3.9/28.0	9.3×10^{-2}	1.2×10^{-2}	12.9/60	6.0×10^{-2}	1.3×10^{-3}
4.8/32.2	5.0×10^{-2}	8.1×10^{-3}	15.5/65	8.0×10^{-3}	7.9×10^{-4}
5.8/36.4	7.6×10^{-3}	3.2×10^{-4}	✧ **18.8/70**	$\mathbf{9.6\times10^{-4}}$	$\mathbf{3.5\times10^{-4}}$
7.0/40.5	2.8×10^{-3}	8.6×10^{-4}	22.9/75	3.8×10^{-4}	8.3×10^{-5}
✧ **8.3/44.4**	$\mathbf{2.5\times10^{-4}}$	$\mathbf{3.0\times10^{-5}}$			
9.8/48.3	1.9×10^{-4}	3.1×10^{-5}			
11.5/52.2	1.3×10^{-4}	1.2×10^{-5}			

REFERENCES

1 Hibino, T.; Ohya, H. Synthesis of Crystalline Layered Double Hydroxides: Precipitation by Using Urea Hydrolysis and Subsequent Hydrothermal Reactions in Aqueous Solutions. *Appl. Clay Sci.* **2009**, 45, 123–132.

2 Liu, Z.; Ma, R.; Osada, M.; Iyi, N.; Ebina, Y.; Takada, K.; Sasaki, T. Synthesis, Anion Exchange, and Delamination of Co-Al Layered Double Hydroxide: Assembly of the Exfoliated Nanosheet/Polyanion Composite Films and Magneto-Optical Studies. *J. Am. Chem. Soc.* **2006**, 128, 4872–4880.