Supporting Information for

## Construction and property of needle-like crystalline AgO ordered structures from Ag-nanoparticles

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Technical Institute of Physics and Chemistry, Chinese Academy of Sciences No. 29 Zhongguancun Donglu, Haidian District, Beijing 100190, China Fax: +86 10 82543573; Tel: +86 10 82543573 As Fig.S1 showed, the diffraction peaks at 32.928, 38.164 and 55.111 were corresponding with JCPDS card of  $Ag_2O$  (NO. 43-0997) and Ag (NO.04-0783). It could be confirmed that the formed substance of the light grey area in Fig.3a3 and Fig.4a3 was a mixture of  $Ag_2O$  and few Ag.



Fig.S1 XRD pattern of the material in the light grey area in Fig.3a3 and Fig.4a3.

Fig.S2 was the Ag3d<sub>5/2</sub> XPS spectra of the prepared AgO. The peak at 368.15 eV and 367.58 eV were fitting peaks of Ag3d<sub>5/2</sub>, which were corresponding to the binding energy of AgO and Ag<sub>2</sub>O respectively.<sup>1</sup> Clearly, the peak area of AgO is much bigger than Ag<sub>2</sub>O, meaning the content of AgO is higher than Ag<sub>2</sub>O. In fact, the actual content of AgO in the sample is much more than that showed in Fig.S5, considering the characteristic of XPS test and AgO material surface easy to decompose.



Fig.S2 XPS spectra of Ag3d<sub>5/2</sub> on the surface of the prepared AgO material.

Fig.S3 showed the discharge ability at 5C rate of as the prepared AgO materials. It could be seen that the AgO prepared by plane contact way showed the higher discharge capacity of 402.3 mAh  $g^{-1}$ , as high as 93.1% of the theory value. Then followed AgO prepared by wire contact and point contact way.



Fig.S3 Discharge curves at 5C rate under 60°C of Al/AgO battery with the highly ordered needlelike AgO as the cathode.

Fig.S4 revealed the XRD pattern of materials after discharge. The diffraction peaks at 38.529, 44.760 and 64.821 respectively index as (111), (200) and (220) crystal planes, perfectly matched with JCPDS card of Ag (NO.04-0783), proved that AgO was completely reduced into Ag after discharge process.



Fig.S4 XRD pattern of the material after discharge.

Reference

1. C.D.Wagner, L.H.Gale, and R.H.Raymond, Analytical Chemistry, 1979, 51, 466-482.