

## **Electronic Supplementary Information (ESI)**

### **Atomic layer deposited aluminum phosphate thin films on N-doped CNTs**

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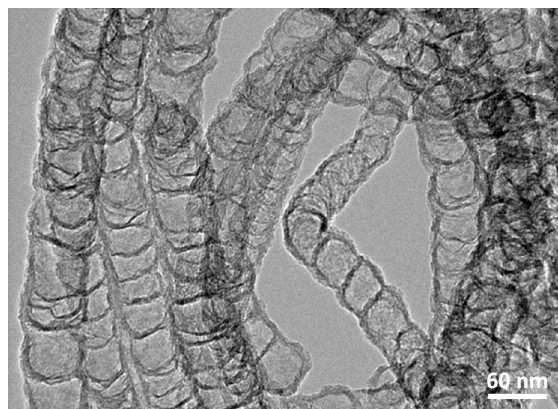


Fig.S1 TEM image of NCNTs

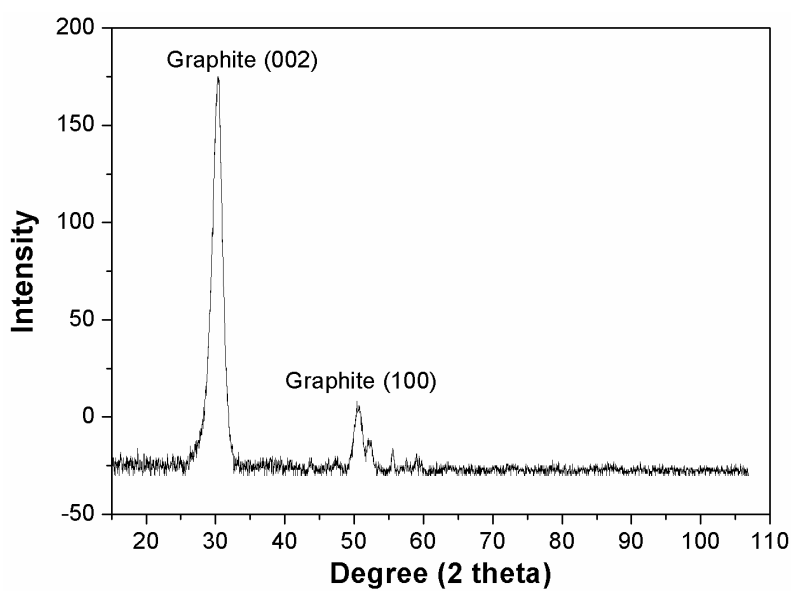


Fig.S2 XRD pattern of NCNTs coated with 100-ALD cycle aluminum phosphate using sequence of  $1 \times (\text{TMA} - \text{H}_2\text{O}) - 20 \times (\text{TMP} - \text{O}_3)$ .

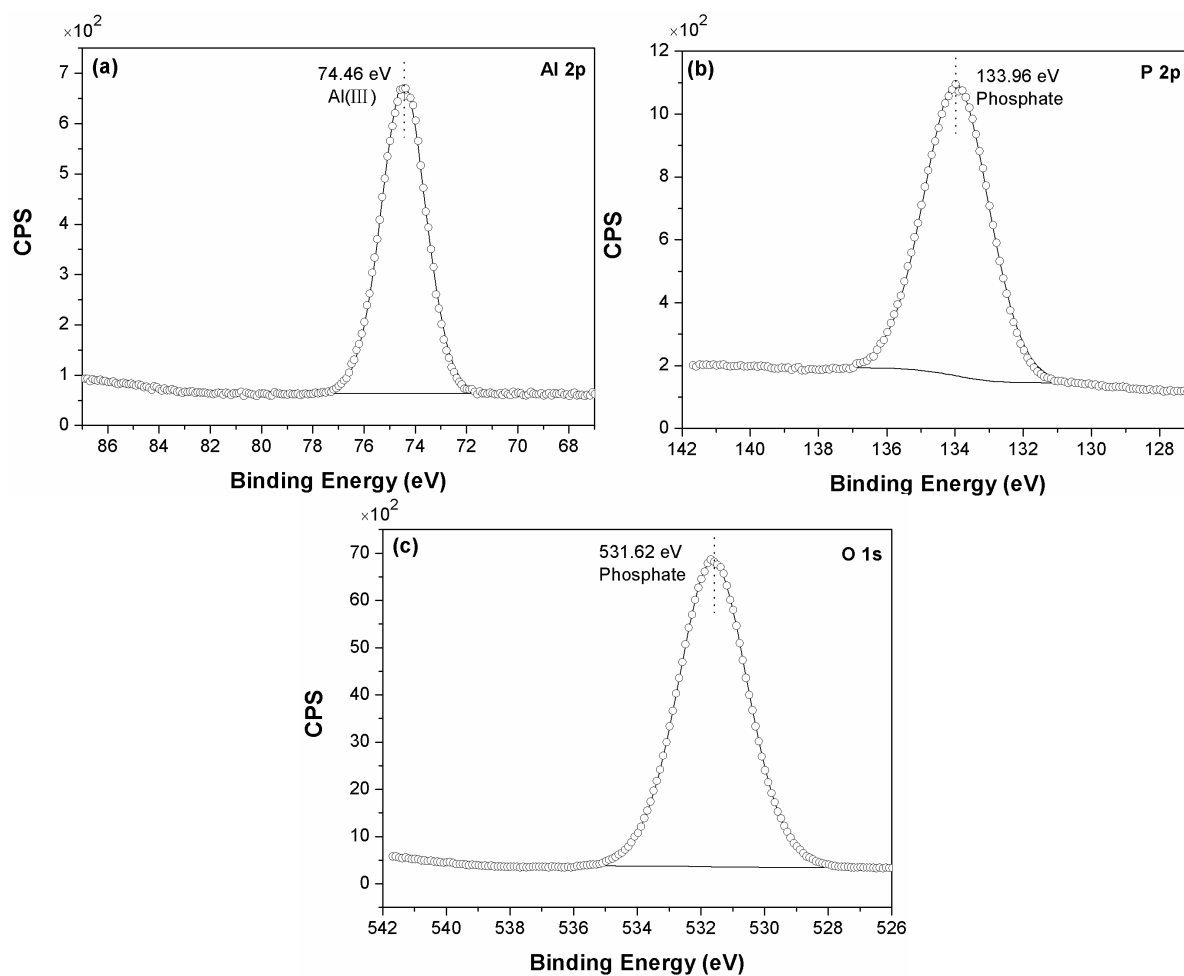


Fig.S3 Deconvolution of Al 2p, P 2p and O 1s peaks together with theoretical fits and background.

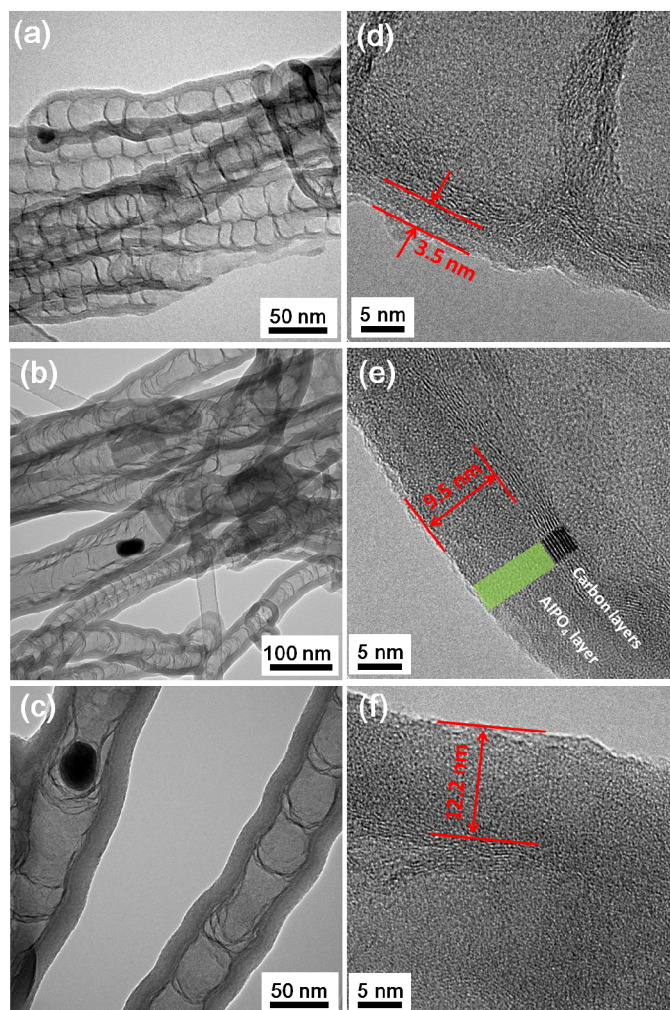


Fig.S4 TEM (a-c) and HRTEM (d-f) images of NCNTs coated with thin films using sequence of  $1 \times (\text{TMA} - \text{H}_2\text{O}) - 20 \times (\text{TMP} - \text{O}_3)$  for 25 (a, d), 50 (b, e), and 75 (c, f) ALD cycles.

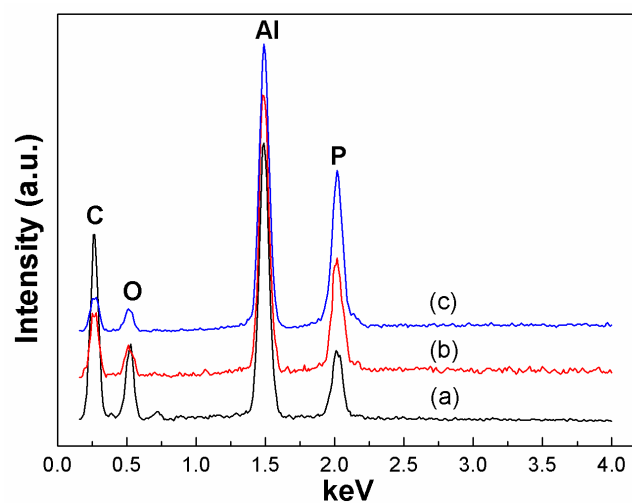


Fig.S5 EDS results of NCNTs coated with 50-ALD cycle aluminum phosphates using sequences of (a)  $1 \times (\text{TMA} - \text{H}_2\text{O}) - 5 \times (\text{TMP} - \text{O}_3)$ ; (b)  $1 \times (\text{TMA} - \text{H}_2\text{O}) - 10 \times (\text{TMP} - \text{O}_3)$  and (c)  $1 \times (\text{TMA} - \text{H}_2\text{O}) - 20 \times (\text{TMP} - \text{O}_3)$ .

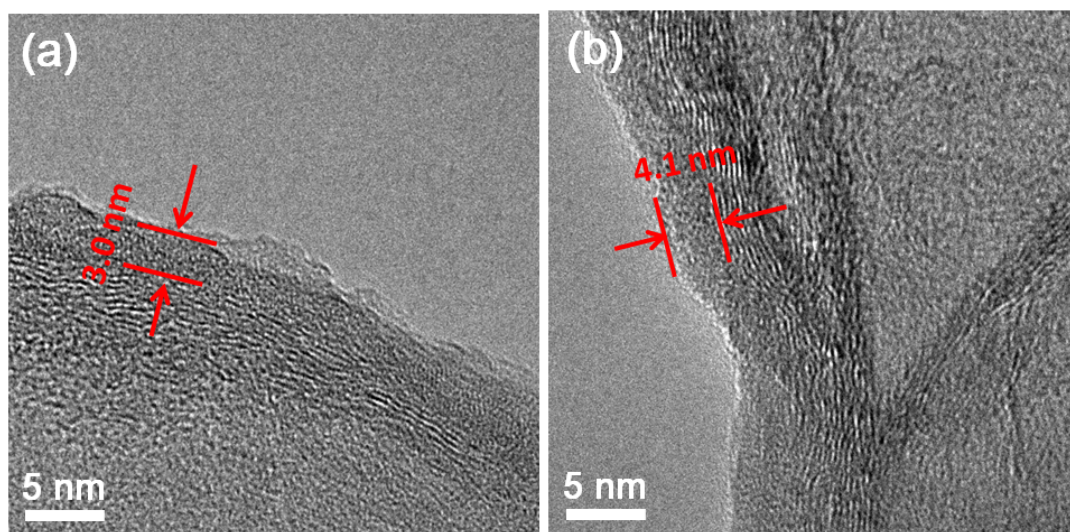


Fig.S6 HRTEM images of NCNTs coated with 50-cycle  $\text{Al}_x\text{P}_y\text{O}_z$  thin films using sequence of (a)  $1 \times (\text{TMA} - \text{H}_2\text{O}) - 5 \times (\text{TMP} - \text{O}_3)$  and (b)  $1 \times (\text{TMA} - \text{H}_2\text{O}) - 10 \times (\text{TMP} - \text{O}_3)$ .