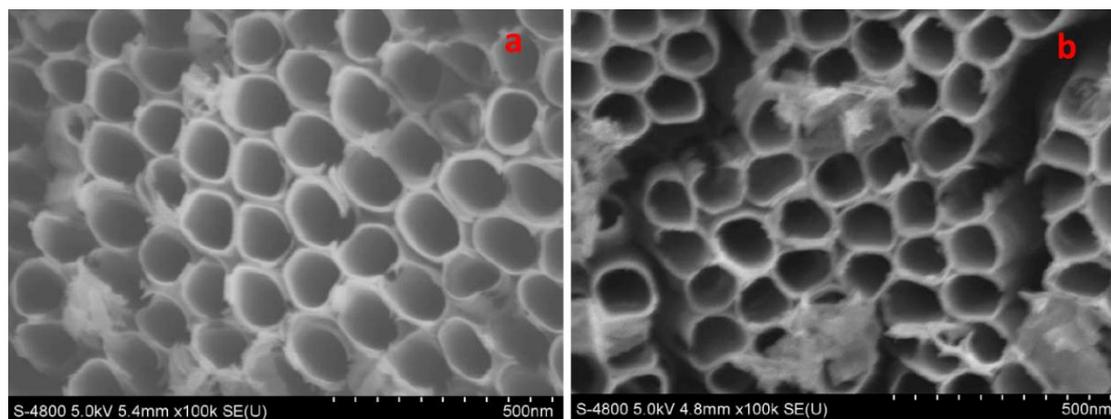
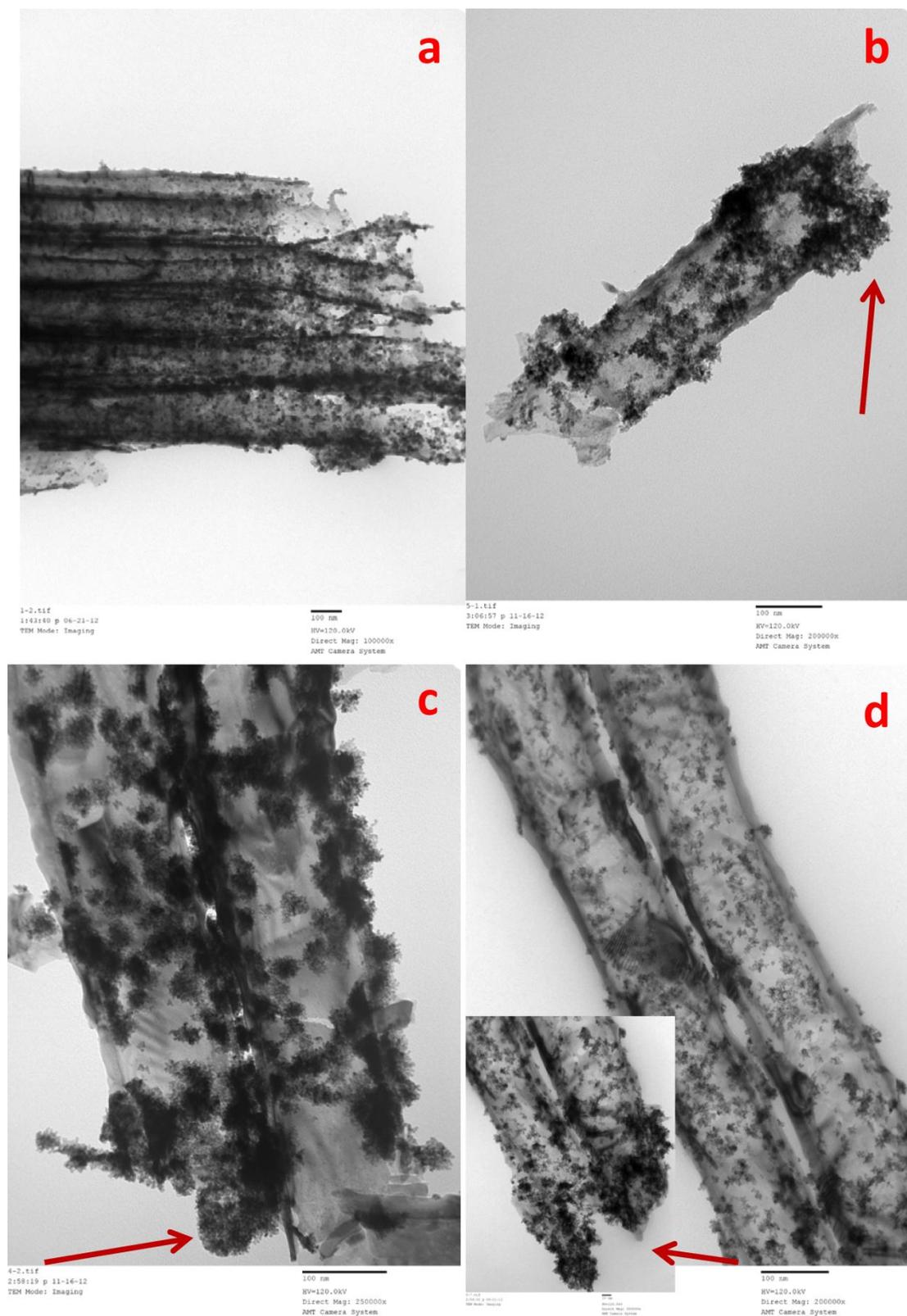


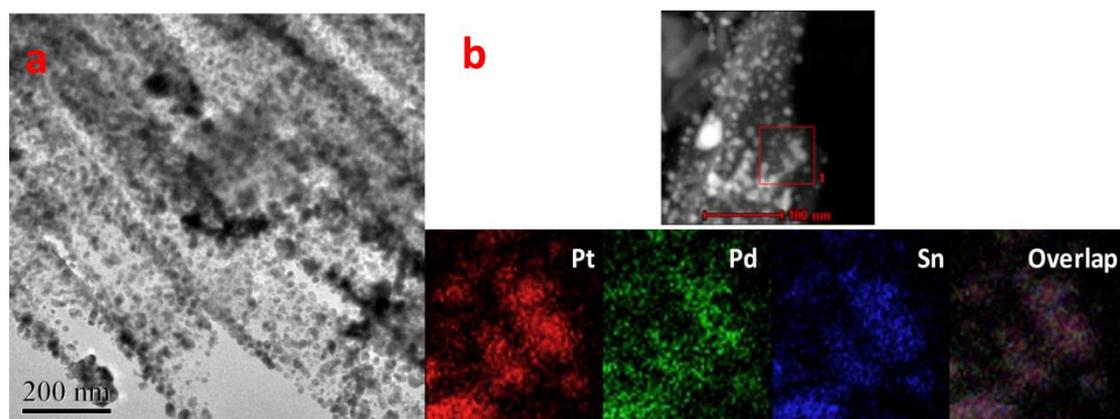
**Supporting Information:**



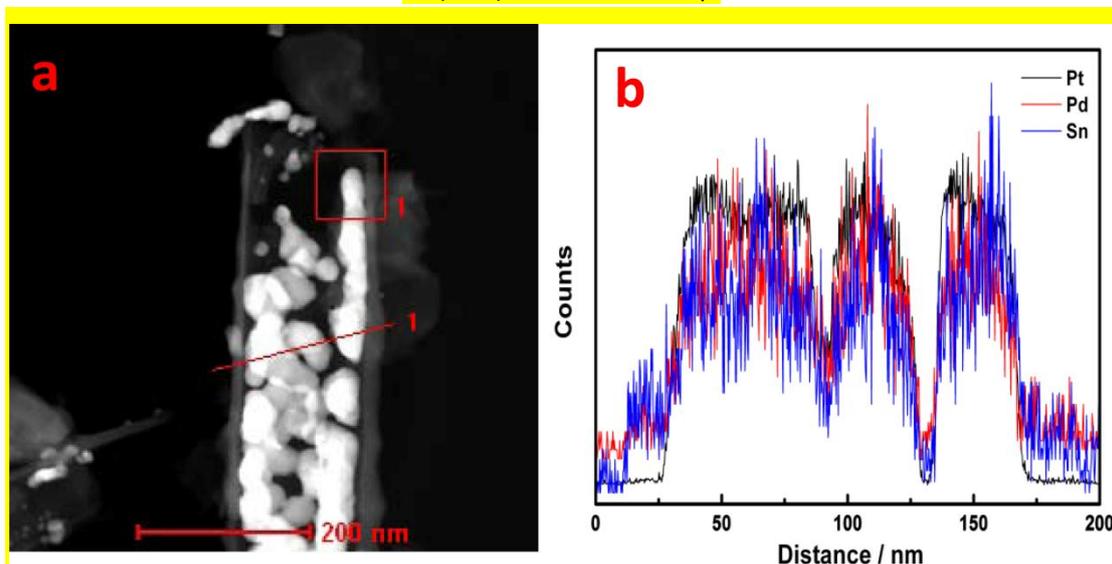
**Figure S1.** (a-b) FESEM image of the H-TNTAs and H-TNTAs-Pt (methanol and water with volume ratio of 16:3).



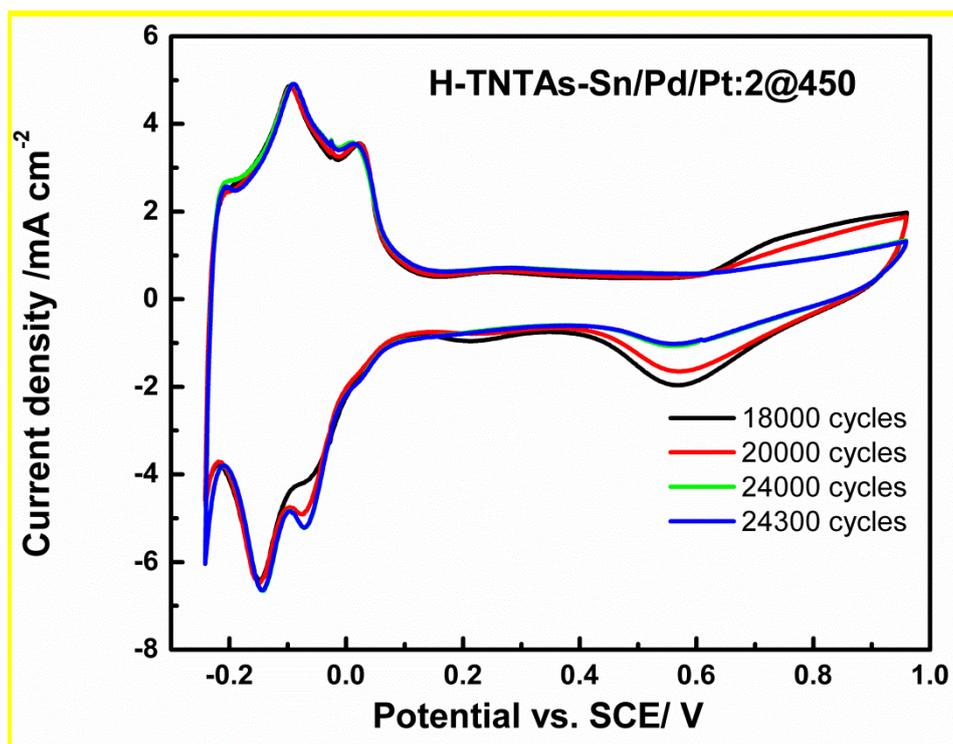
**Figure S2.** (a) TEM image of the H-TNTAs-Sn/Pd with four SIAR cycles. (b-d) TEM image of the H-TNTAs-Sn/Pd/Pt:1 (methanol and water with volume ratio of 16:3), H-TNTAs-Sn/Pd/Pt:2 (17.5:1.5) and H-TNTAs-Sn/Pd/Pt:3 (20:1).



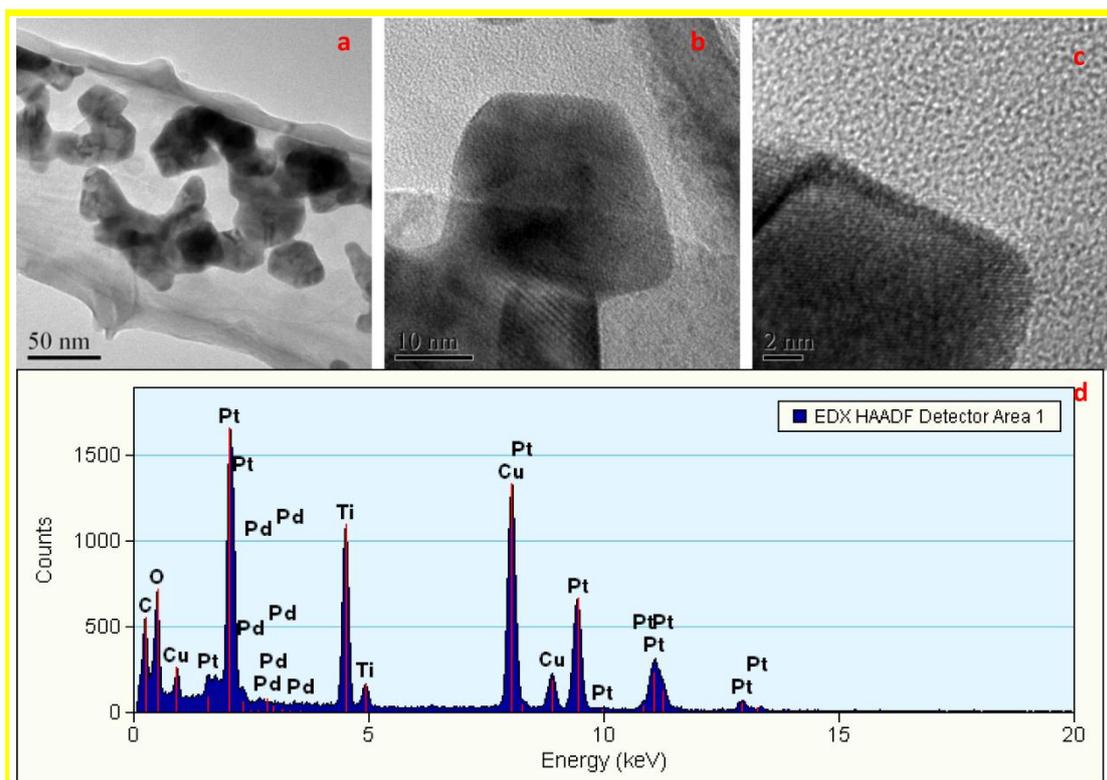
**Figure S3.** (a) TEM image of the H-TNTAs-Sn/Pd:2@450 without water doped during the hydrogen treatment. (b) HAADF-STEM characterization of the H-TNTAs-Sn/Pd:2@450 without water doped during the hydrogen treatment and the elemental mapping of Pt (red), Pd (green), Sn (blue), and their overlap.



**Figure S4.** (a) HAADF-STEM characterization of the H-TNTAs-Sn/Pd:2@450 and line profiles of the alloy catalyst.



**Figure S5.** CV properties as ADT of the H-TNTAs-Sn/Pd/Pt:2@450 from 18,000 to 24,300 cycles



**Figure S6.** (a-c) HRTEM image of the H-TNTAs-Sn/Pd/Pt:2@450 after 24,000 potential cycles between -0.14 and 0.96 V vs.SCE. (d) The energy-dispersive X-ray spectroscopy (EDX) analysis of Figure S6a.