

Electronic Supplementary Information

Cu₂O sensitized flexible 3D-TiO₂ nanotube arrays for enhancing visible photo-electrochemical performance

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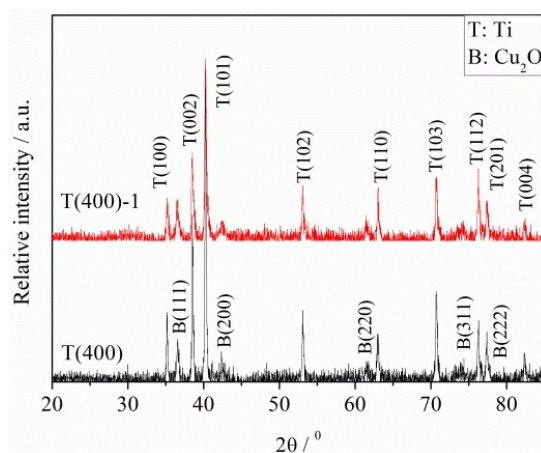


Fig.S1. The XRD patterns of samples T(400) and T(400)-1, T(400): Cu₂O was electrochemically deposited on blank Ti mesh with 400 pulse cycles, T(400)-1: after degradation experiment of sample T(400) under simulated sunlight illumination for 4h.

Fig.S1 indicates that five peaks appear at 36.52°, 42.42°, 61.55°, 73.73° and 77.61° in the samples T(400) and T(400)-1 besides Ti peaks, which can be assigned to (111), (200), (220), (311) and (222) crystal faces of cubic Cu₂O (JCPDS, card no: 77-0199), T(400) and T(400)-1 have nearly the same Cu₂O peak position and intensity, indicating that Cu₂O is stable after the degradation experiment. No CuO diffraction peak is found in these samples.

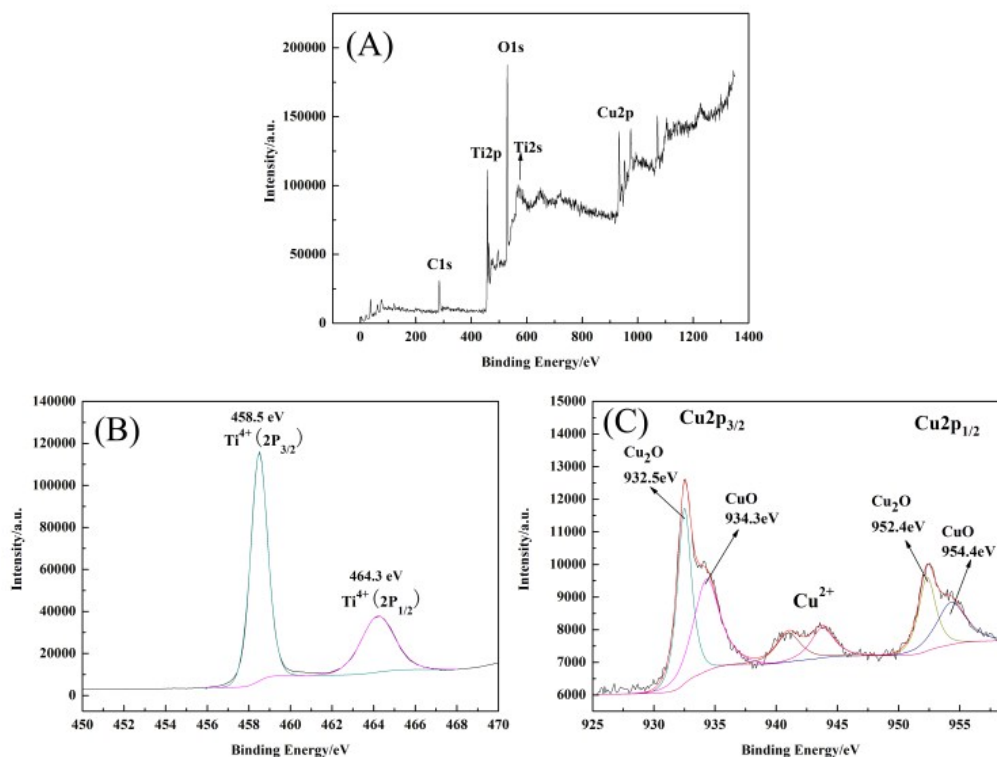


Fig.S2. The XPS spectra of CT(400): XPS survey spectrum (A), high resolution XPS spectra of Ti2p (B) and Cu2p (C)

Fig.S2 gives the XPS spectra of CT(400) in order to further clarify the chemical states of Cu. Fig.S2(A) indicates that the sample contains Cu, Ti, O and C elements. The small amount of carbon could have resulted from adventitious hydrocarbons from the XPS instrument itself and can be taken as the standard signal for the correction of other peaks. The binding energy of the superfluous carbon in our detection is C 1s = 284.8 eV, the same as the standard value. Fig.S2(B) indicates that two main peaks exist at bonding energies of 458.5 and 464.3 eV, which are consistent with that of Ti⁴⁺ 2p_{3/2} and Ti⁴⁺ 2p_{1/2}, respectively. [1,2] Fig.S2(C) indicates the existence of Cu 2p_{3/2} and Cu 2p_{1/2}. Peak Cu 2p_{3/2} can be fitted by two peaks at 934.3 and 932.5 eV, which can be assigned to the Cu(II)[3] state and the Cu(I)[4] state, respectively. Similarly, Peak Cu 2p_{1/2} can be fitted by two peaks at 952.4 and 954.4 eV, which can be assigned to the Cu(II)[3] state and the Cu(I)[4] state, respectively. The shakeup satellite peaks around 940.5 and 944.5 eV suggest the existence of fully oxidized Cu²⁺. [5] The existence of Cu²⁺ ions indicate that the surface of Cu₂O in 3D TiO₂ NTAs was partially oxidized into CuO, but its concentration is very low since no CuO diffraction peak is found in the XRD diagram of CT(400) in Fig.5(A).

References

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