

Supporting information

**Photoelectrochemical Activity of TiO₂/MWCNT Thin-Film Electrodes with
Different Film Structures Prepared by Combining Electrophoretic Deposition and
Sol–Gel Method**

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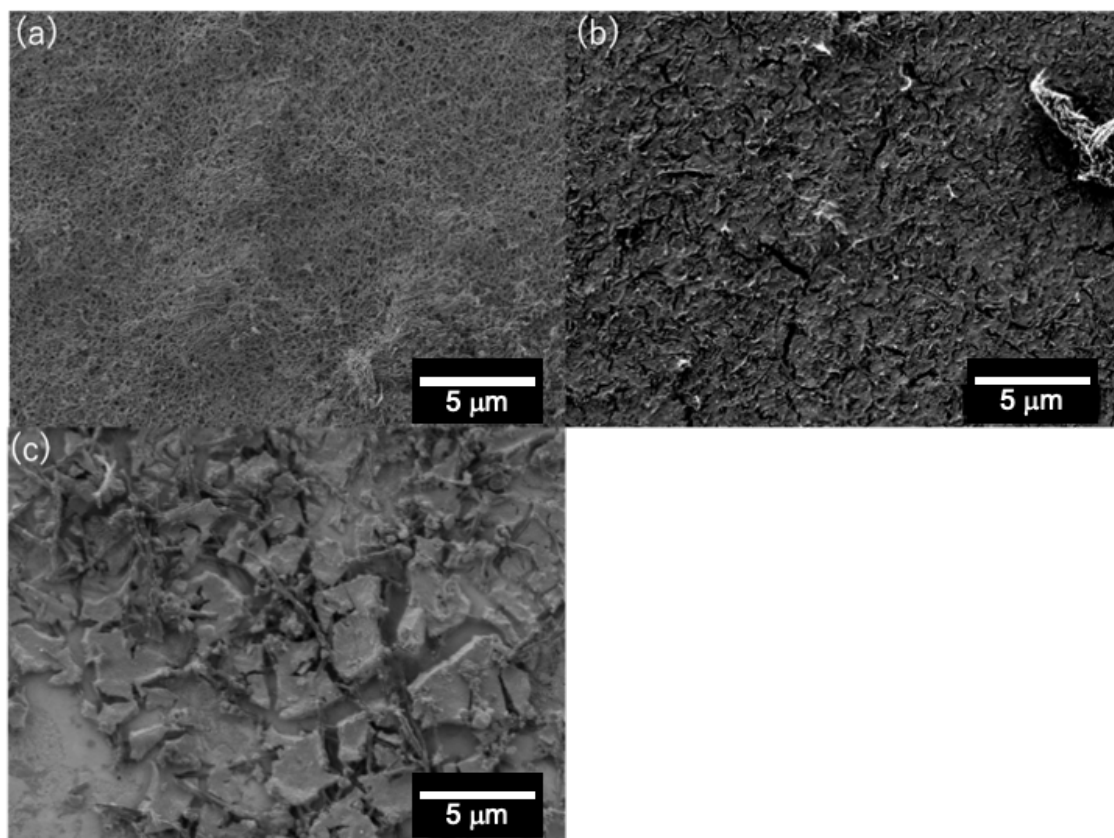
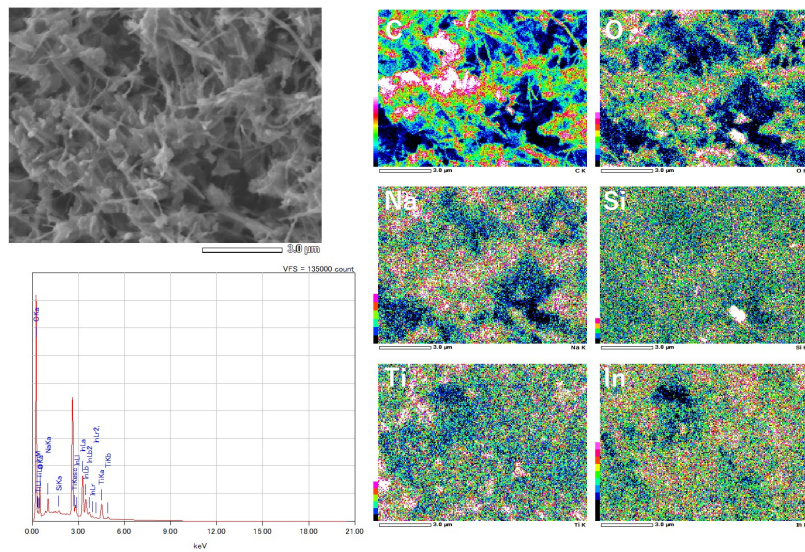
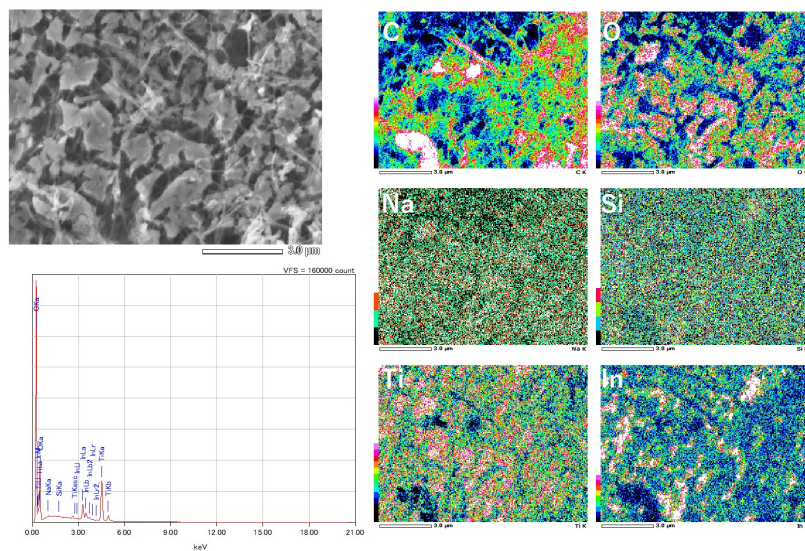


Fig.S1 SEM images of the tops of TiO₂/MWCNT composite thin films prepared with TiO₂ sol ratios of (a) 0.25, (b) 1,75, and (c) 2.0.

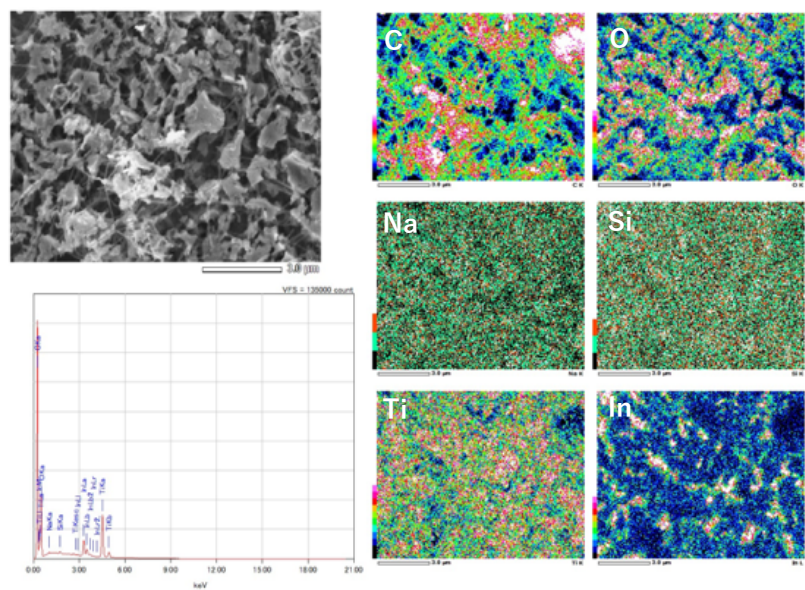
(a) $\text{TiO}_2/\text{MWCNT-0.5}$



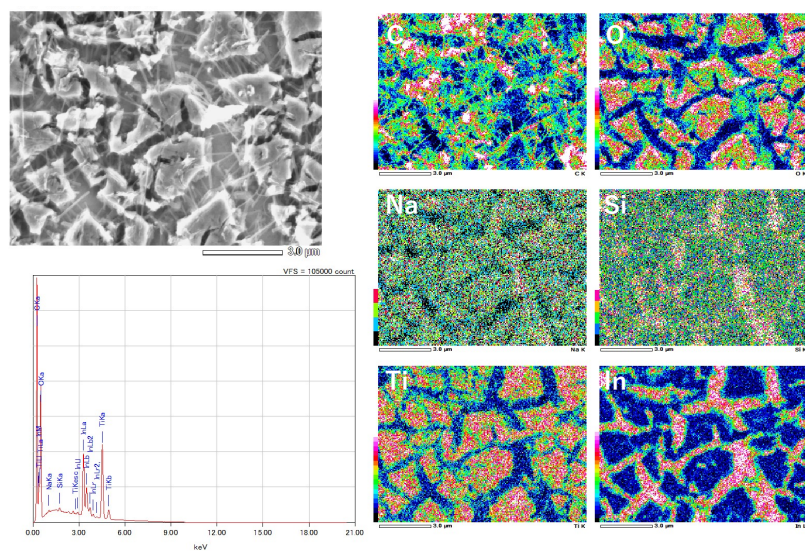
(b) $\text{TiO}_2/\text{MWCNT-0.75}$



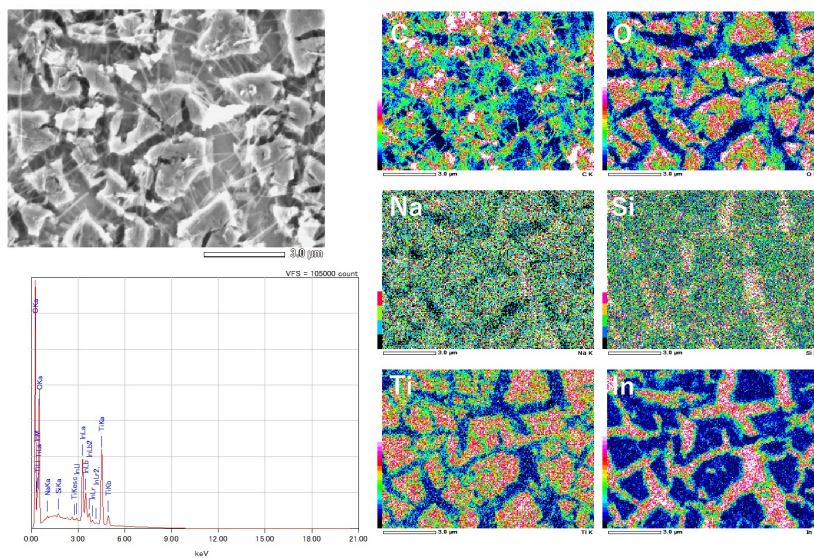
(c) $\text{TiO}_2/\text{MWCNT-0.9}$



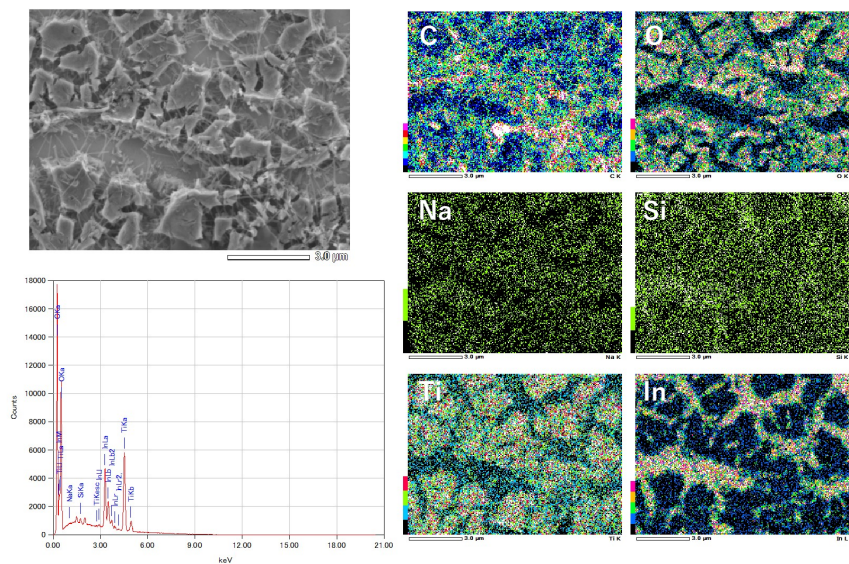
(d) $\text{TiO}_2/\text{CNT-1}$



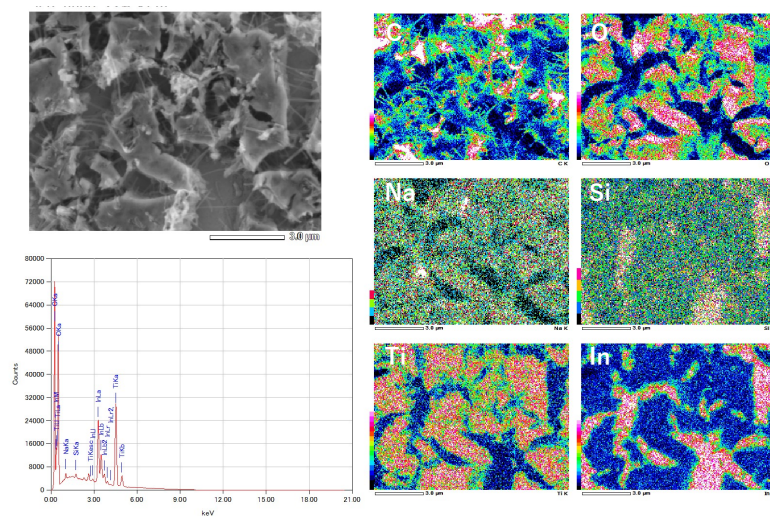
(e) $\text{TiO}_2/\text{MWCNT-1.1}$



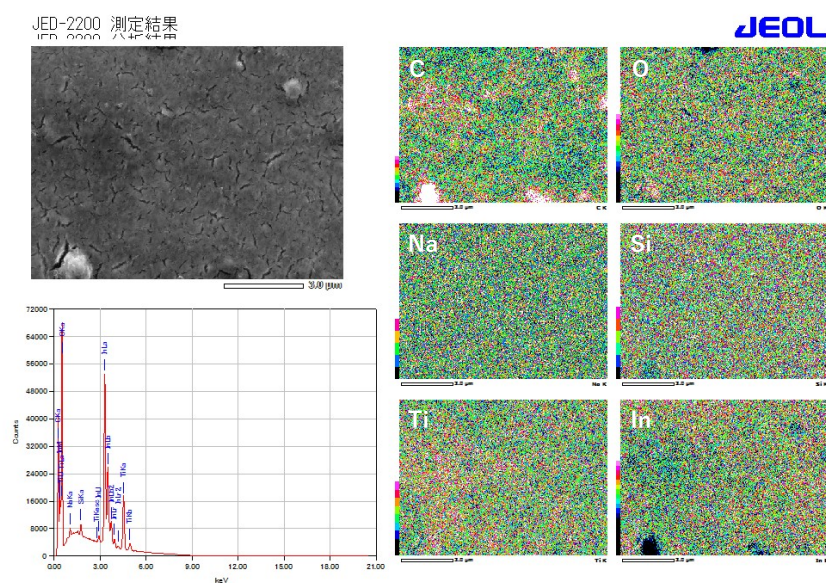
(f) $\text{TiO}_2/\text{MWCNT-1.25}$



(g) $\text{TiO}_2/\text{MWCNT-1.5}$



(h) $\text{TiO}_2/\text{MWCNT}$ -1.0 (BA Excluded)



(i)

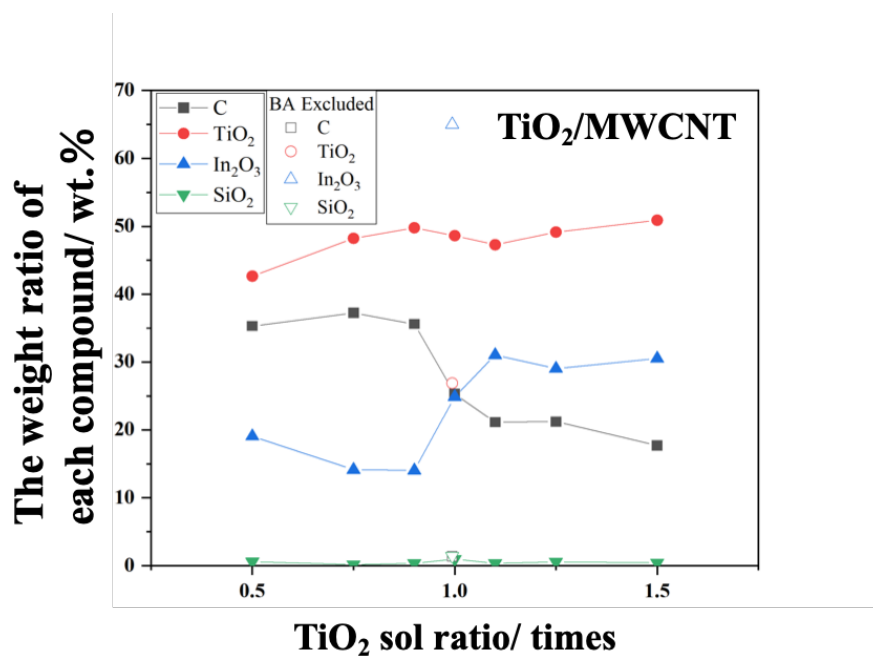


Fig.S2 (a–g) EDS mapping images and (i) weight ratio of each compound estimated by EDS for $\text{TiO}_2/\text{MWCNT}$ composite thin films prepared with different TiO_2 sol ratios.

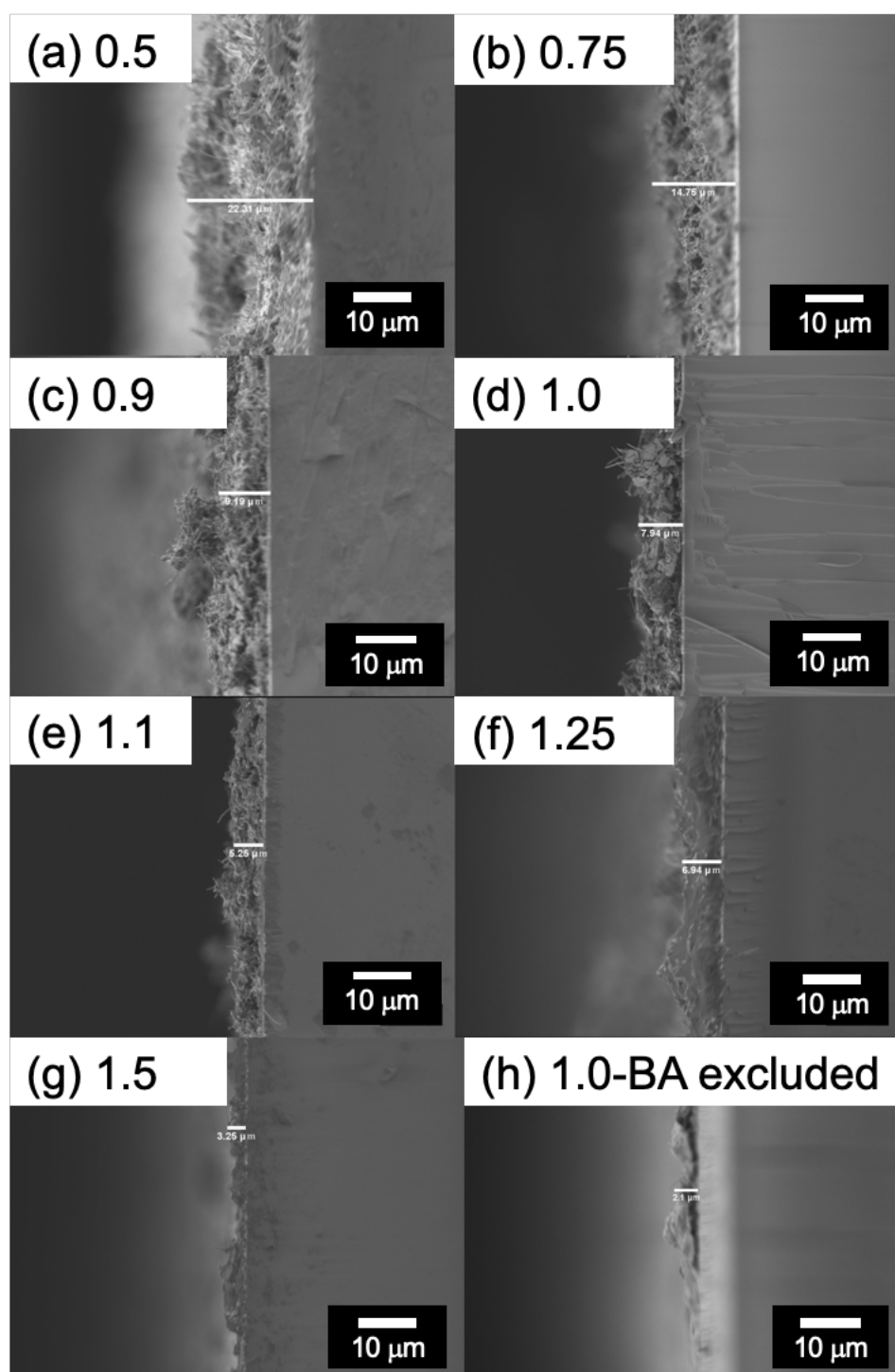


Fig.S3 Cross-sectional SEM images of TiO₂/MWCNT thin-film electrodes with different TiO₂ sol ratios.

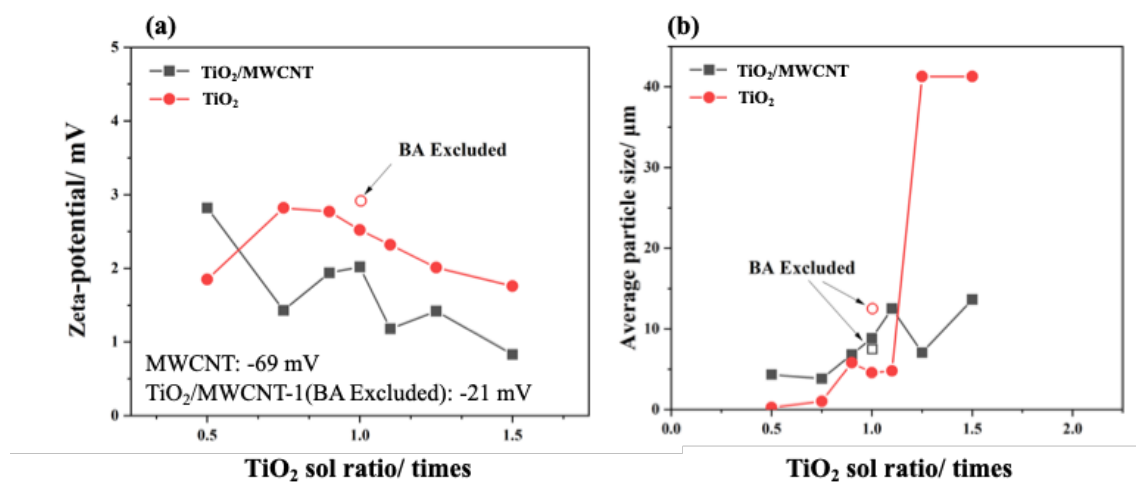


Fig.S4 (a) Zeta potential and (b) average particle size of each electrophoresis bath with and without MWCNT at different TiO_2 sol ratios.

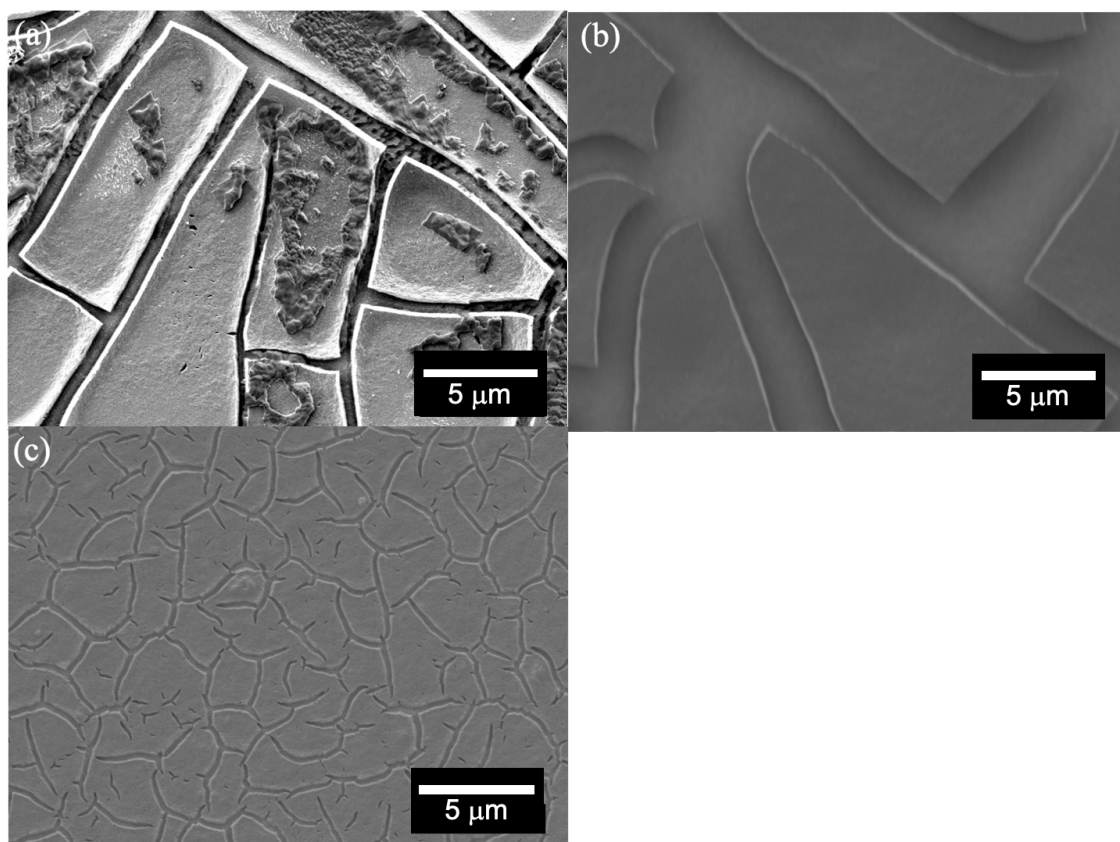
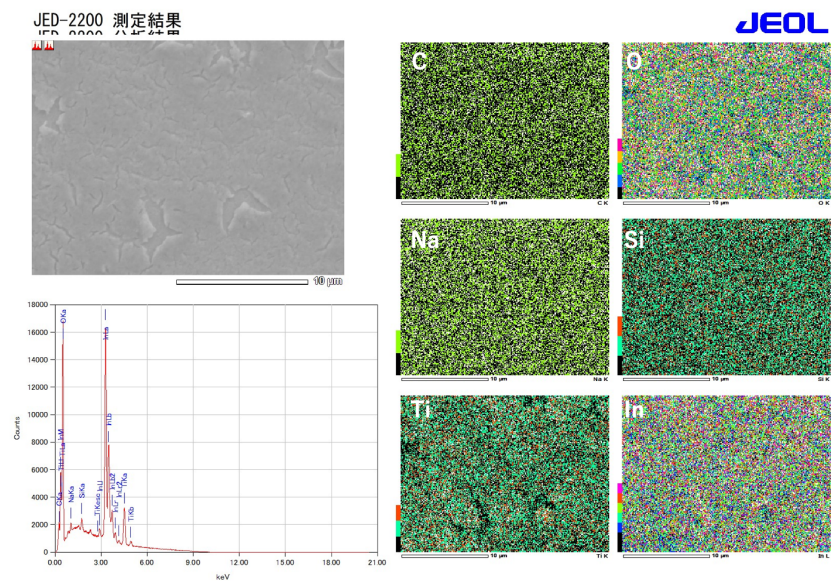
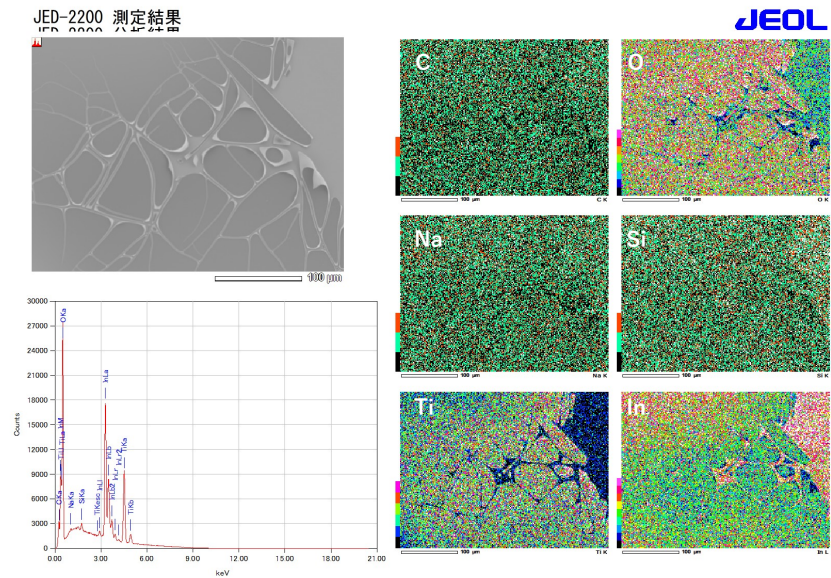


Fig.S5. SEM images of the top of TiO₂ thin films prepared with TiO₂ sol ratios of (a) 0.25, (b) 1.75, and (c) 2.0.

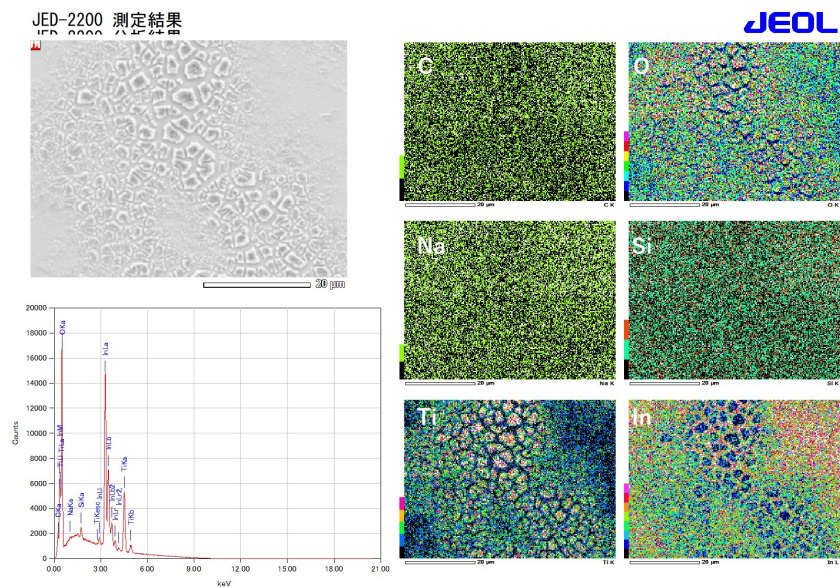
(a) $\text{TiO}_2\text{-}0.5$



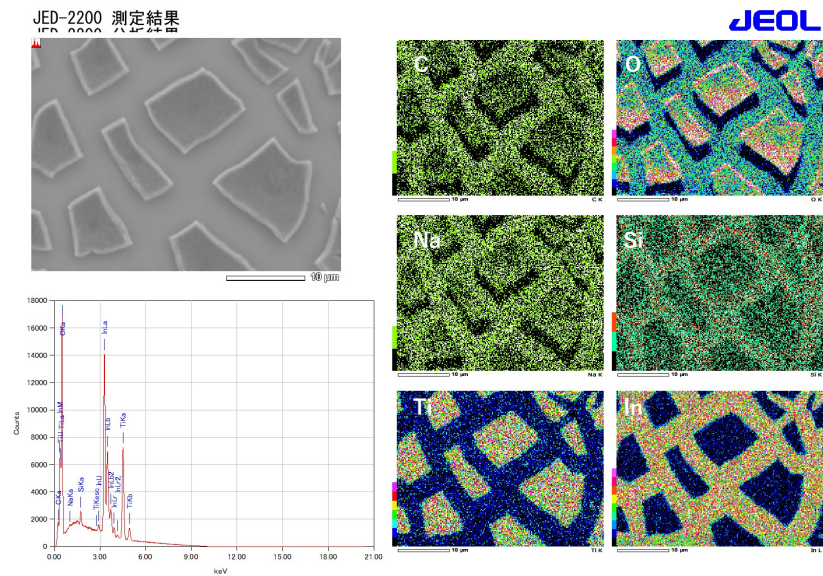
(b) $\text{TiO}_2\text{-}0.75$



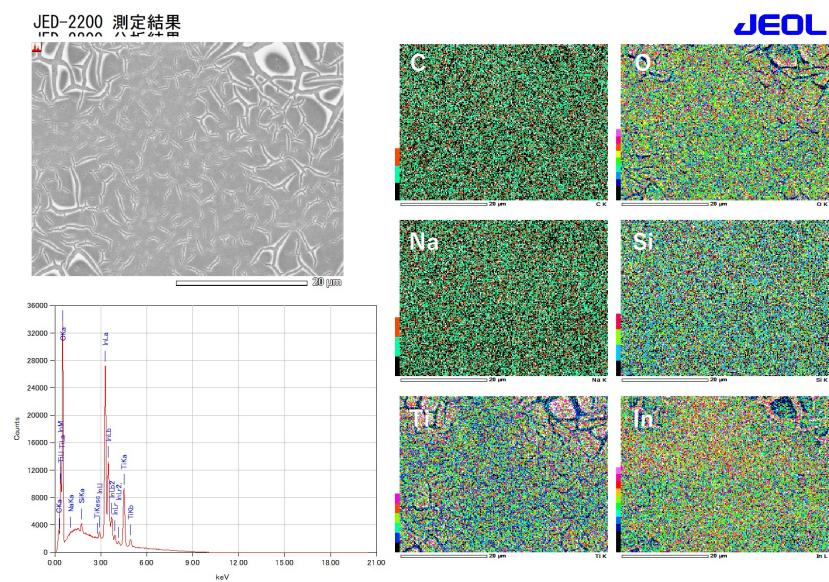
(c) $\text{TiO}_2\text{-0.9}$



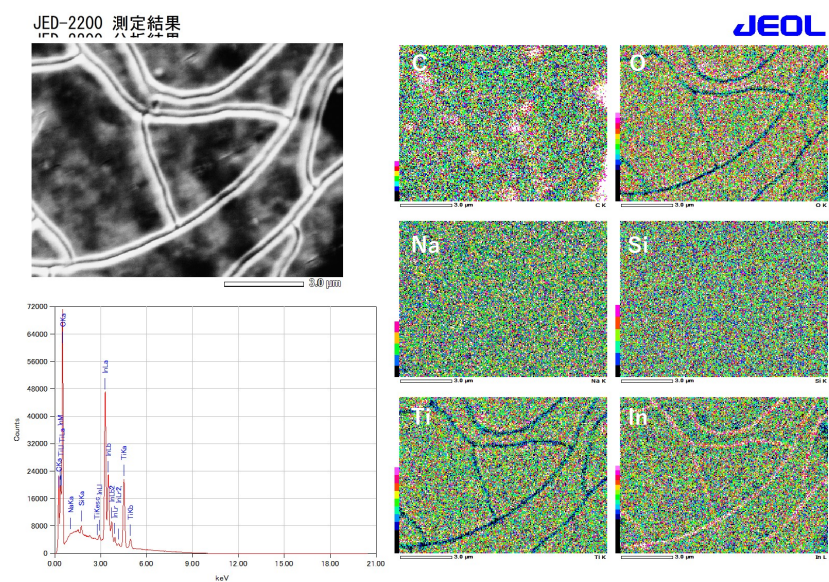
(d) $\text{TiO}_2\text{-1.0}$



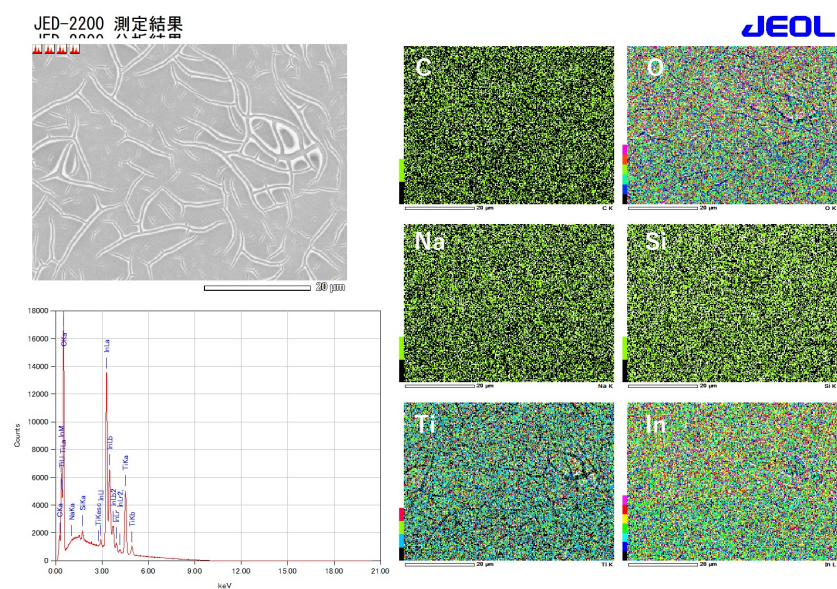
(e) TiO_2 -1.1



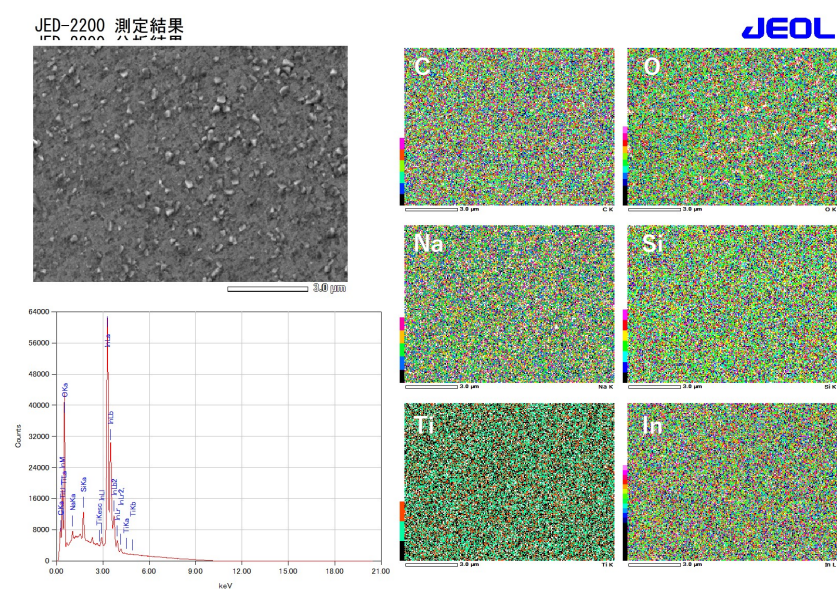
(f) TiO_2 -1.25



(g) $\text{TiO}_2\text{-1.5}$



(h) $\text{TiO}_2\text{-1.0 (BA Excluded)}$



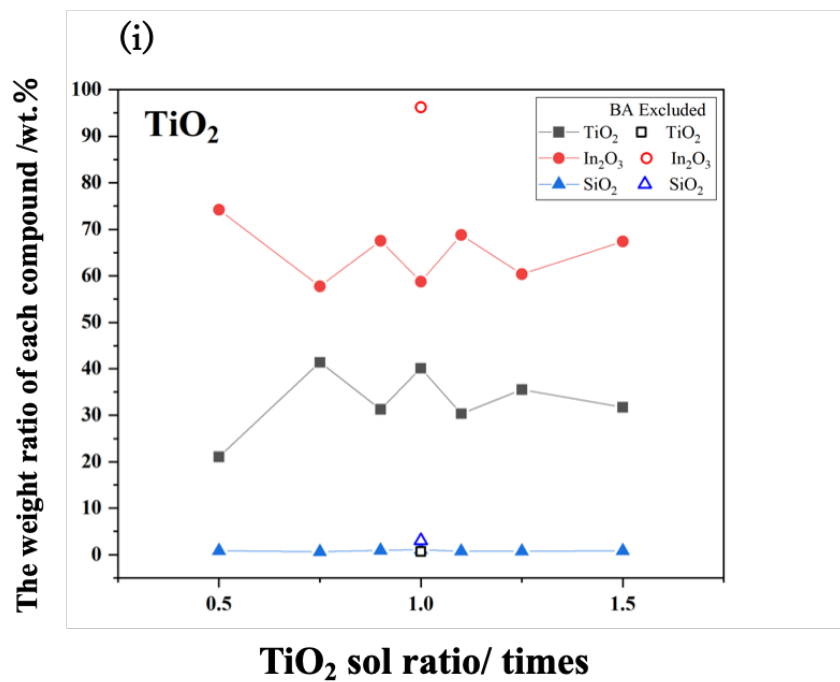


Fig.S6. (a–h) EDS mapping images and (i) weight percentage of each compound estimated by EDS for the TiO₂ thin films prepared with different TiO₂ sol ratios.

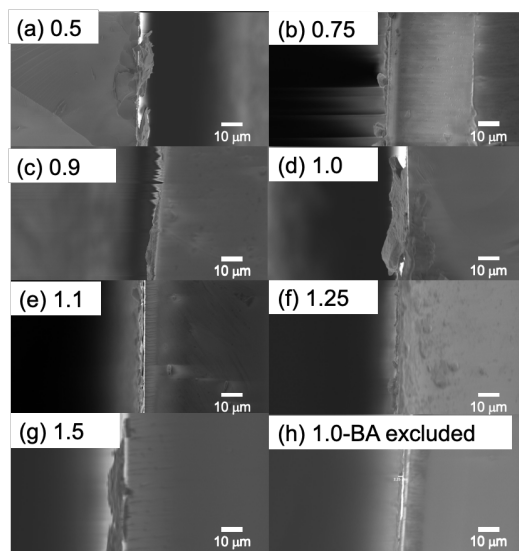
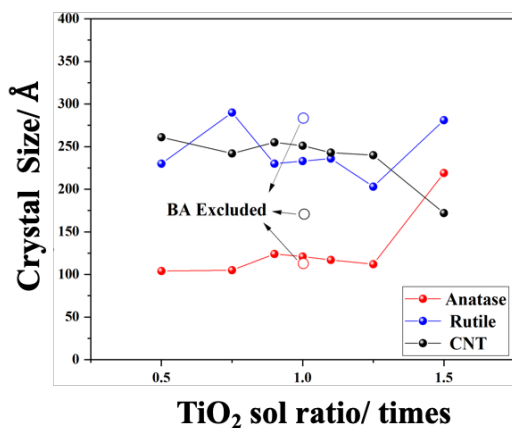


Fig.S7 Cross-sectional SEM images of the TiO₂ thin-film electrodes with different TiO₂ sol weights.

(a) $\text{TiO}_2/\text{MWCNT}$



(b) TiO_2

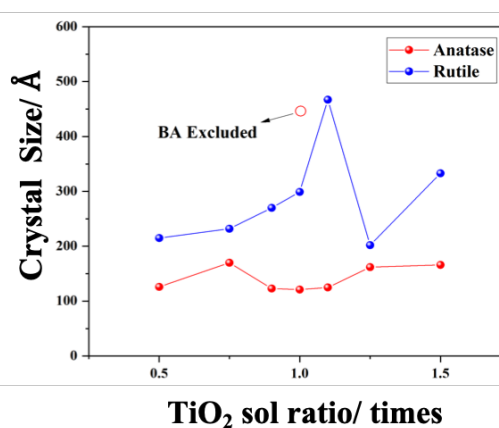


Fig.S8 Crystal sizes of anatase and rutile TiO_2 and CNT in (a) $\text{TiO}_2/\text{MWCNT}$ and (b) TiO_2 thin films calculated from the half-width of the corresponding XRD peaks using the Scherrer formula. The crystal size of rutile for the TiO_2 thin film prepared without BA is excluded from (b) because it is too large compared with the other values (1525 Å).

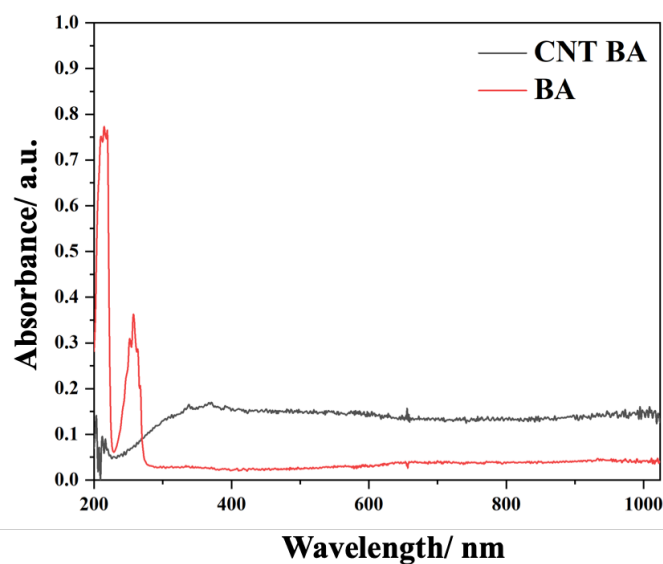


Fig.S9 UV absorption spectra of 2-propanol solutions with both MWCNT and BA (black line) and only BA (red line). The concentrations were the same as those for the electrophoresis bath used throughout the study.

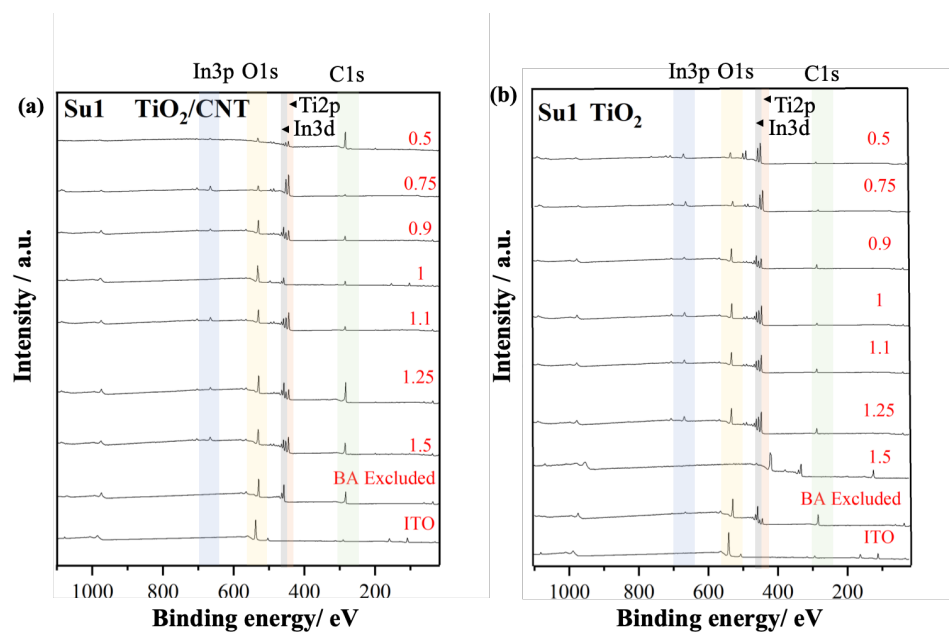


Fig.S10 Pristine XPS wide spectra of (a) $\text{TiO}_2/\text{MWCNT}$ and (b) TiO_2 thin-film electrodes prepared with different TiO_2 sol ratios.

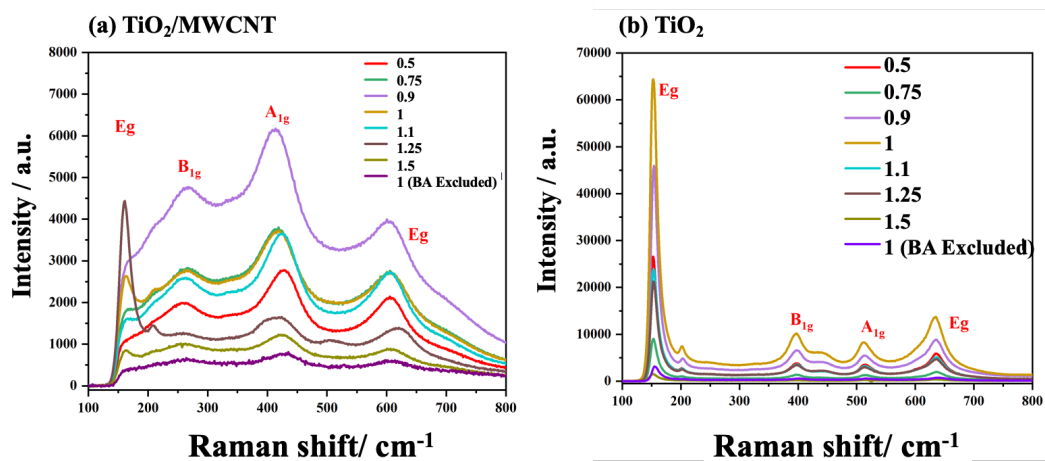


Fig.S11. Raman spectra of (a) $\text{TiO}_2/\text{MWCNT}$ and (b) TiO_2 thin-film electrodes in the range of 100–800 cm^{-1} .