Electronic Supplementary Information

Water oxidation by manganese oxides, a new step towards a complete picture: Simplicity is the ultimate sophistication

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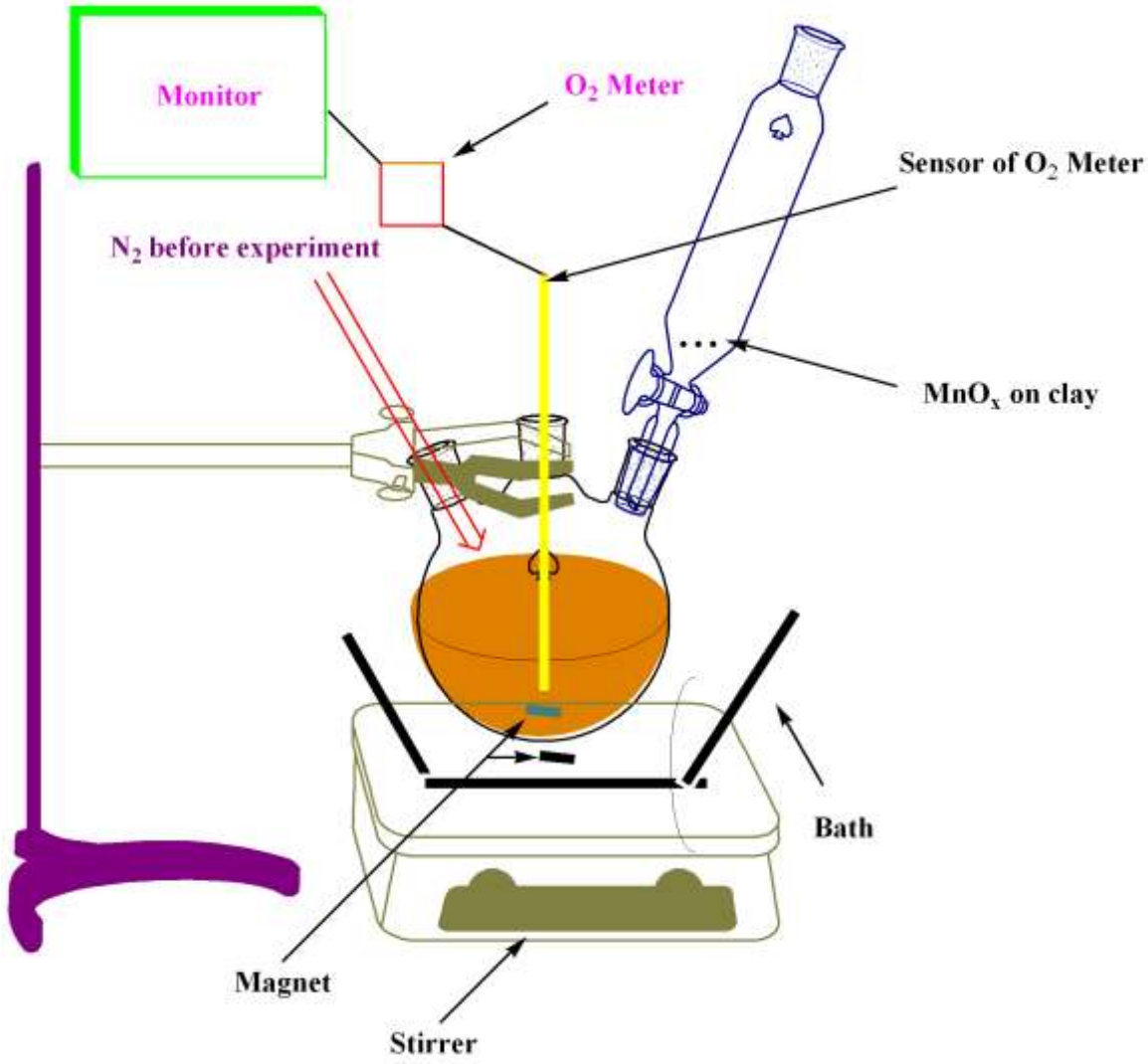


Figure S1. The reactor set-up for oxygen evolution experiment in the presence of Ce(IV).

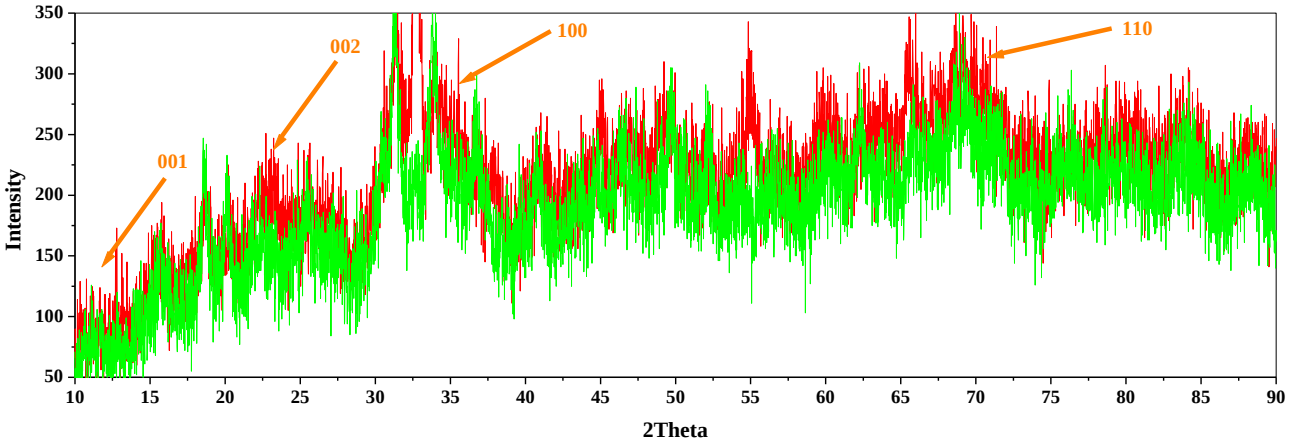


Figure S2. The XRD patterns show that both Mn_2O_3 and $CaMn_3O_6$ compounds after reaction with Ce(IV) convert to the same compound with layered structure.

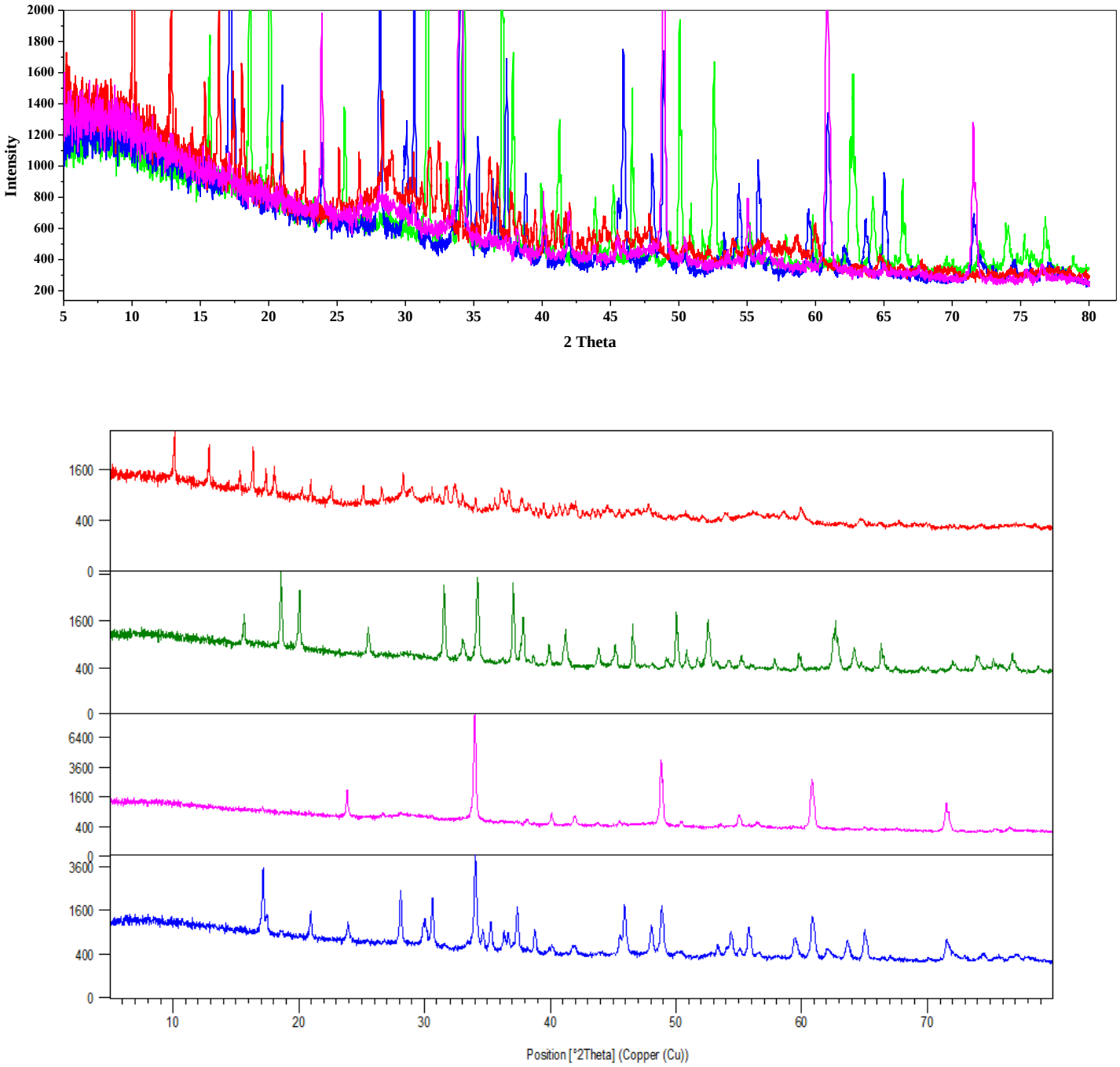
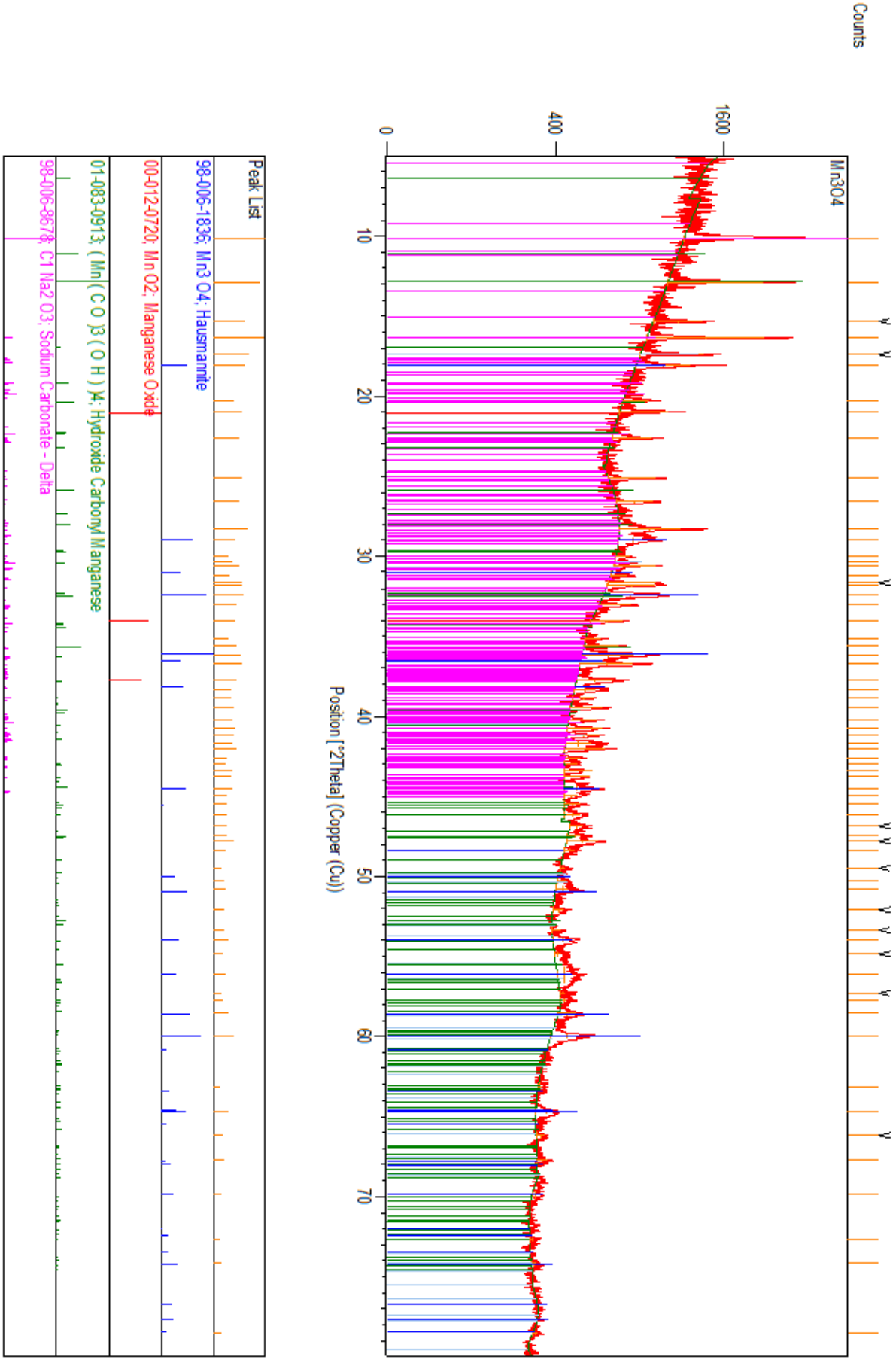
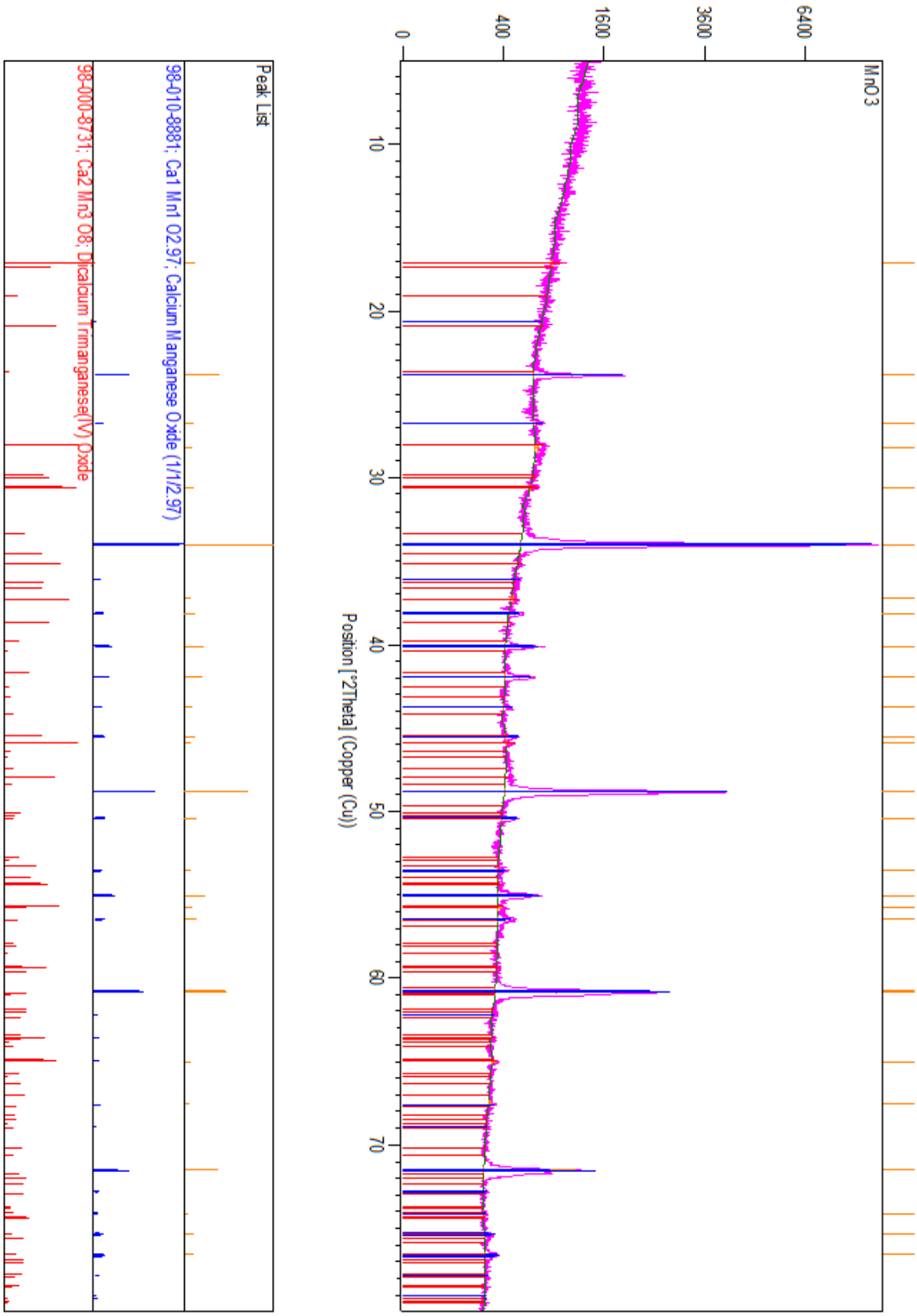


Figure S3. XRD patterns obtained from $Ca_2Mn_3O_8$ (blue), $CaMnO_3$ (pink), $CaMn_4O_8$ (green) and Mn_3O_4 (red) after reaction by Ce(IV) (1.8 M, one months) by FFT method. FFT Filter Smoothing is a signal processing technique typically used to remove noise from signals. For more information see: http://www.originlab.com/www/helponline/Origin/en/Category/Smoothing.html.
Very careful analysis of XRD with FFT method shows that crystalline phases from many samples ($Ca_2Mn_3O_8$, $CaMnO_3$, $CaMn_4O_8$) are not changed but convert to a layered phase with poor crytalinity.



(a)



(b)

Figure S4. Details for XRD patterns obtained for Mn3O4 (a) and CaMnO3 (b).

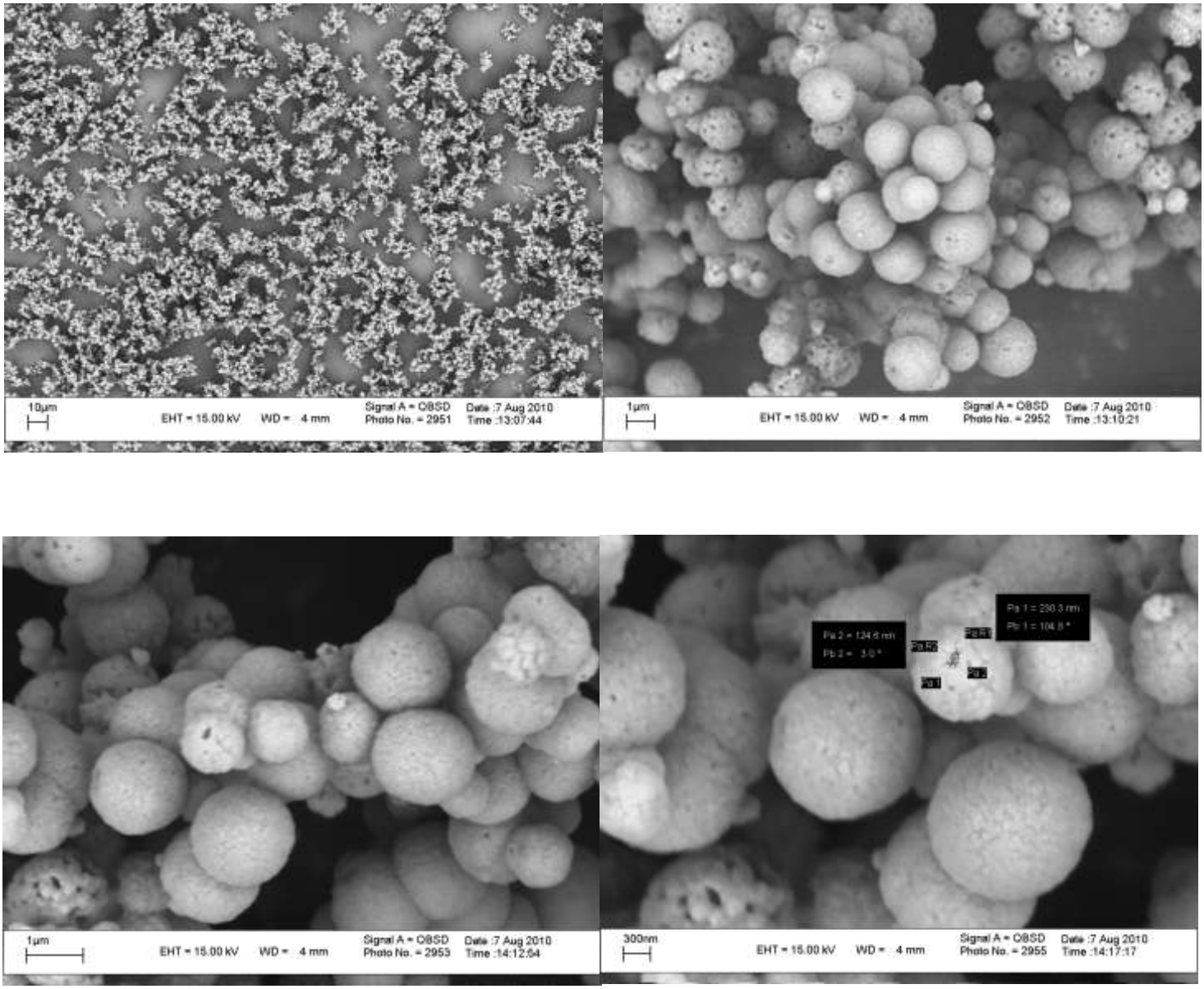


Figure S5. SEM images of $Ca_2Mn_3O_8$.

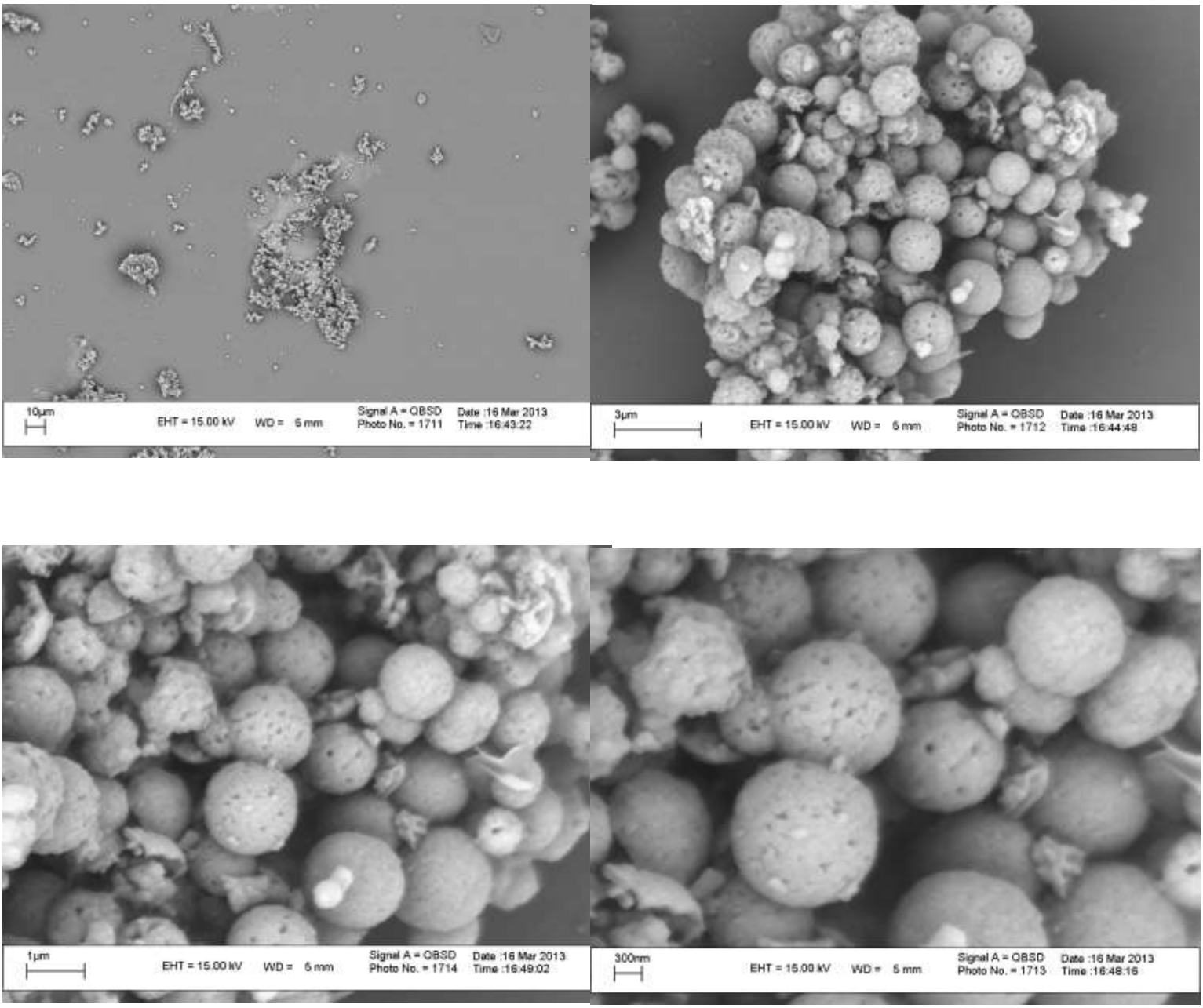


Figure S6. SEM images of $Ca_2Mn_3O_8$ after treating with Ce(IV) (1.8 M, for one month).

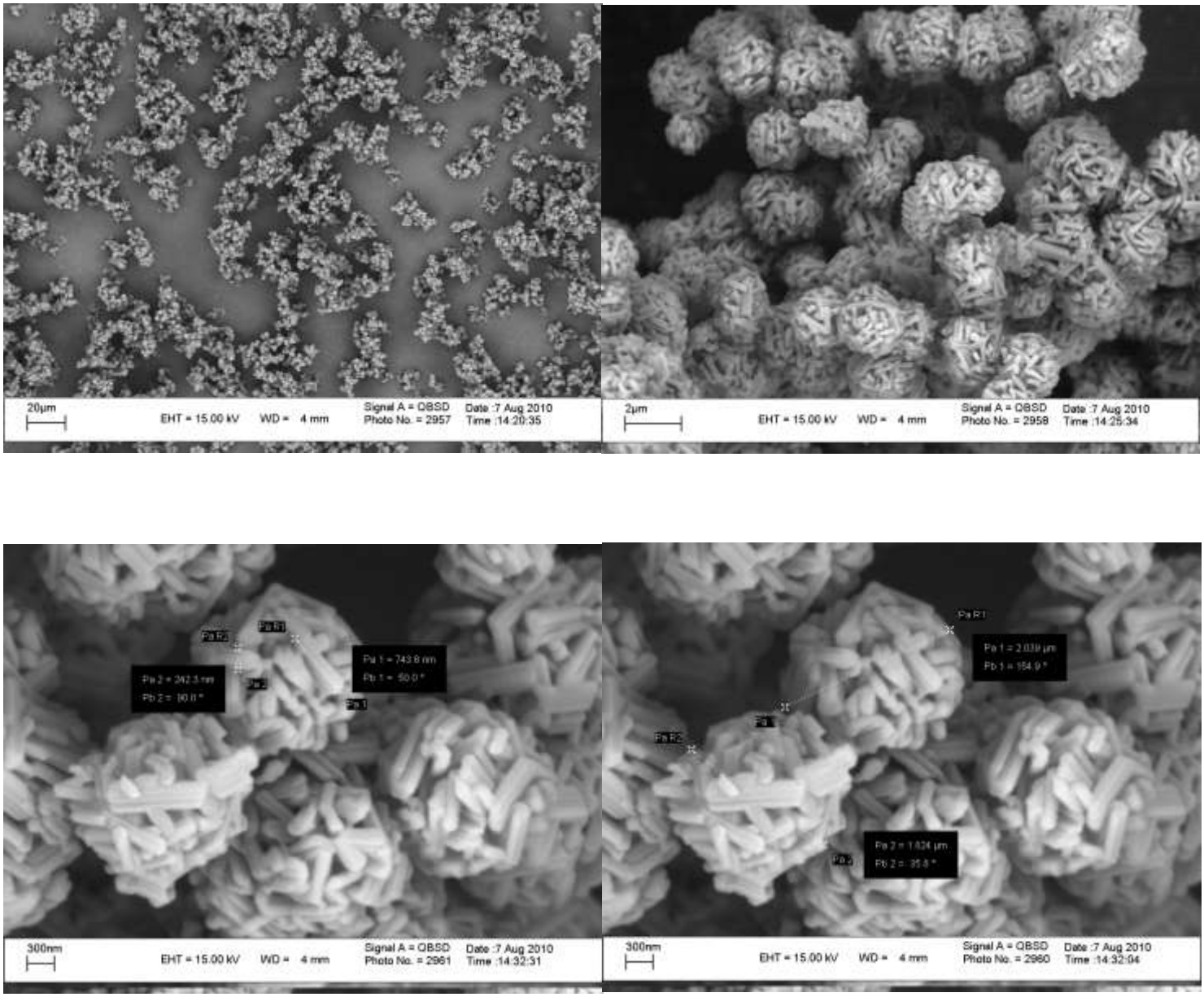


Figure S7. SEM images of $CaMn_3O_6$.

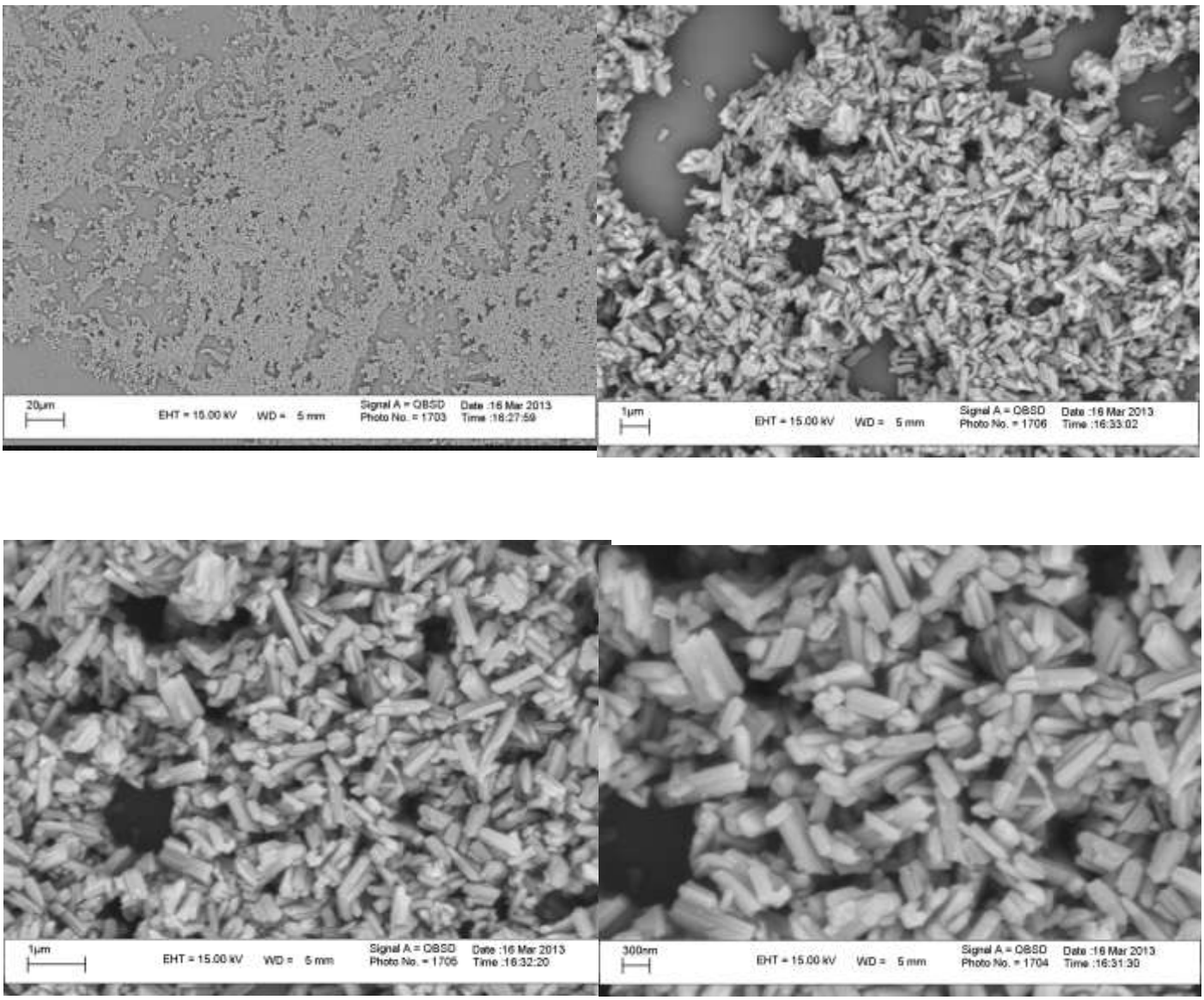


Figure S8. SEM images of $CaMn_3O_6$ after treating with Ce(IV) (1.8 M, for one month).

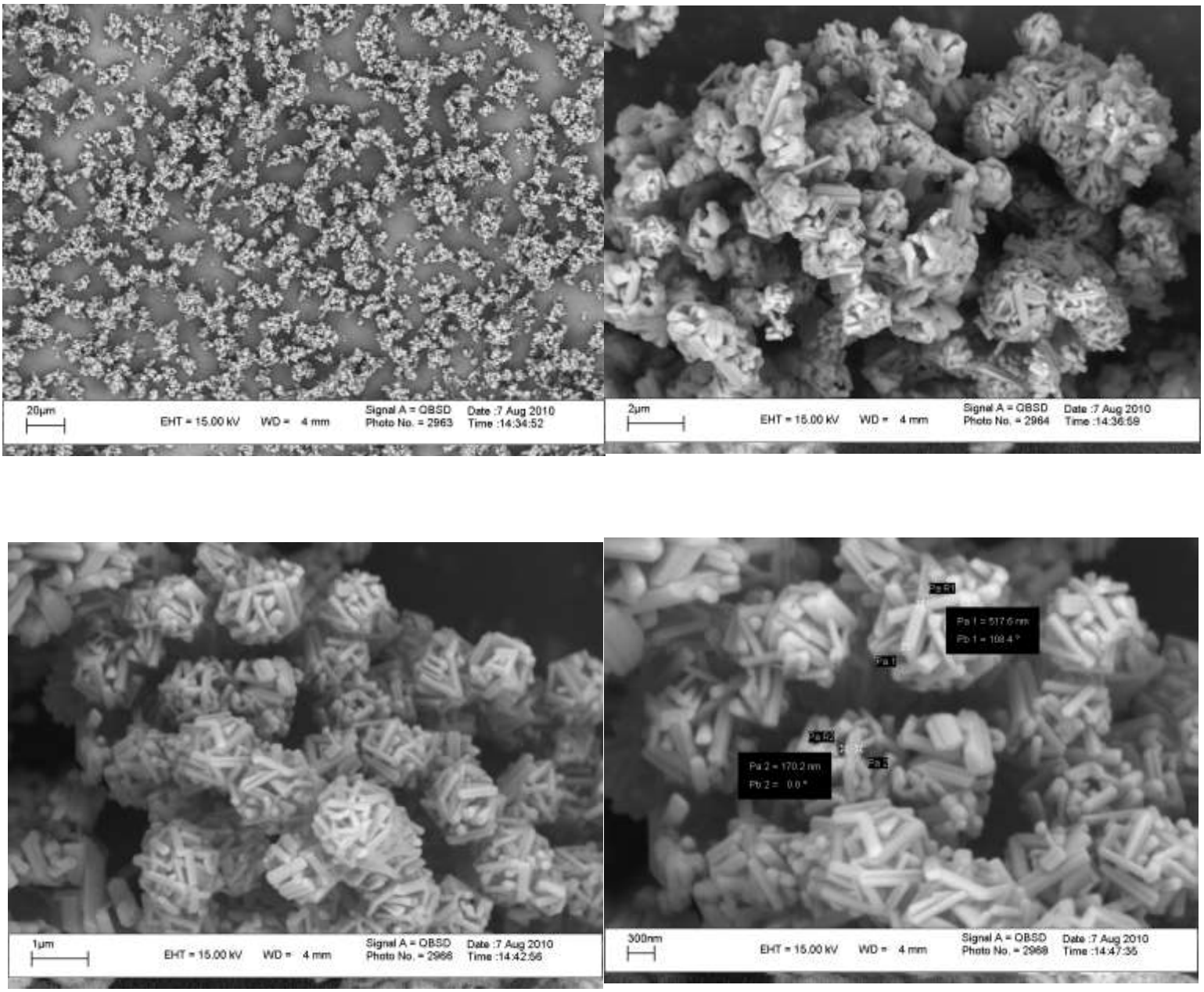


Figure S9. SEM images of $CaMn_4O_8$.

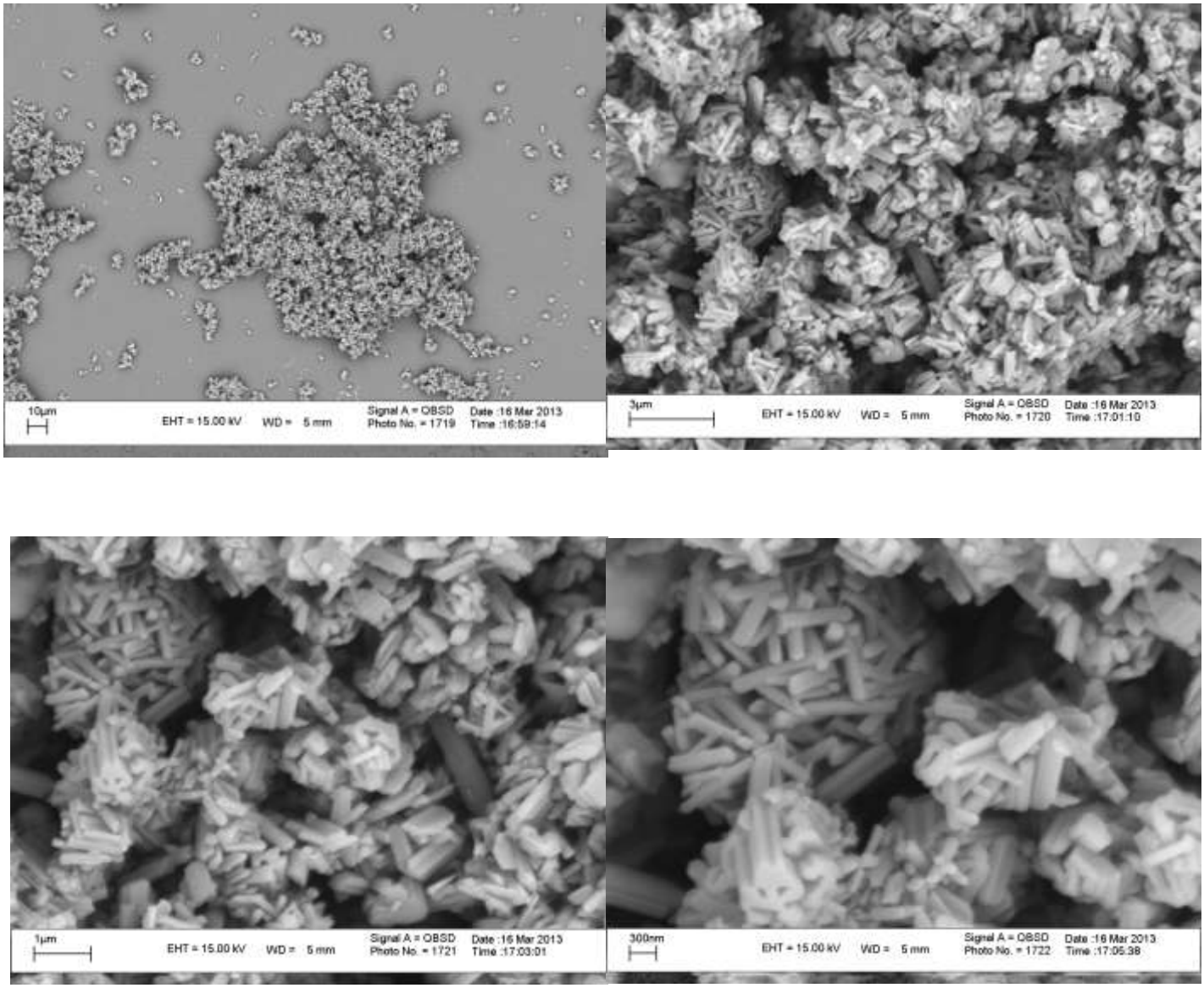


Figure S10. SEM images of $CaMn_4O_8$ after treating with Ce(IV) (1.8 M, for one month).

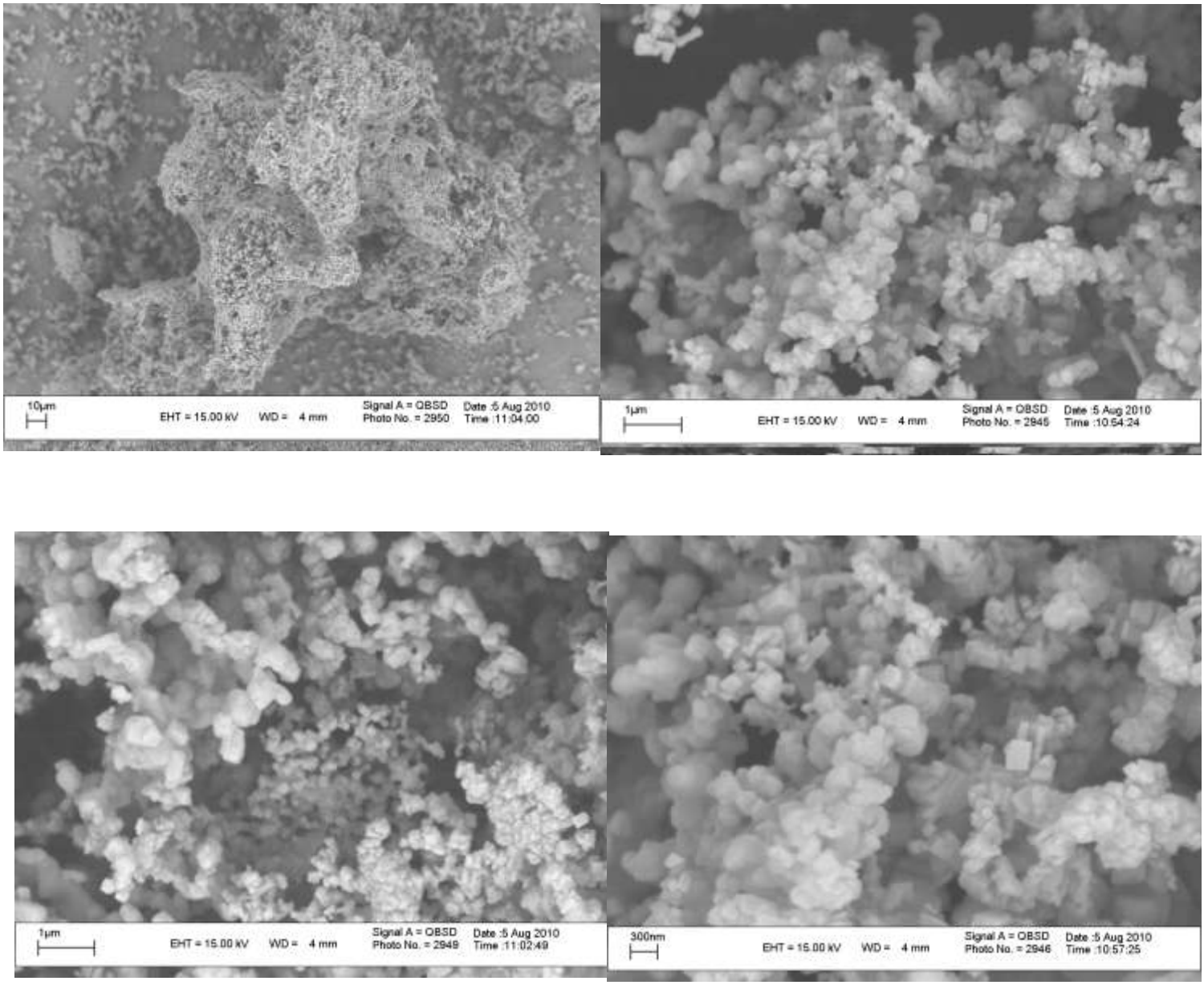


Figure S11. SEM images of $CaMnO_3$.

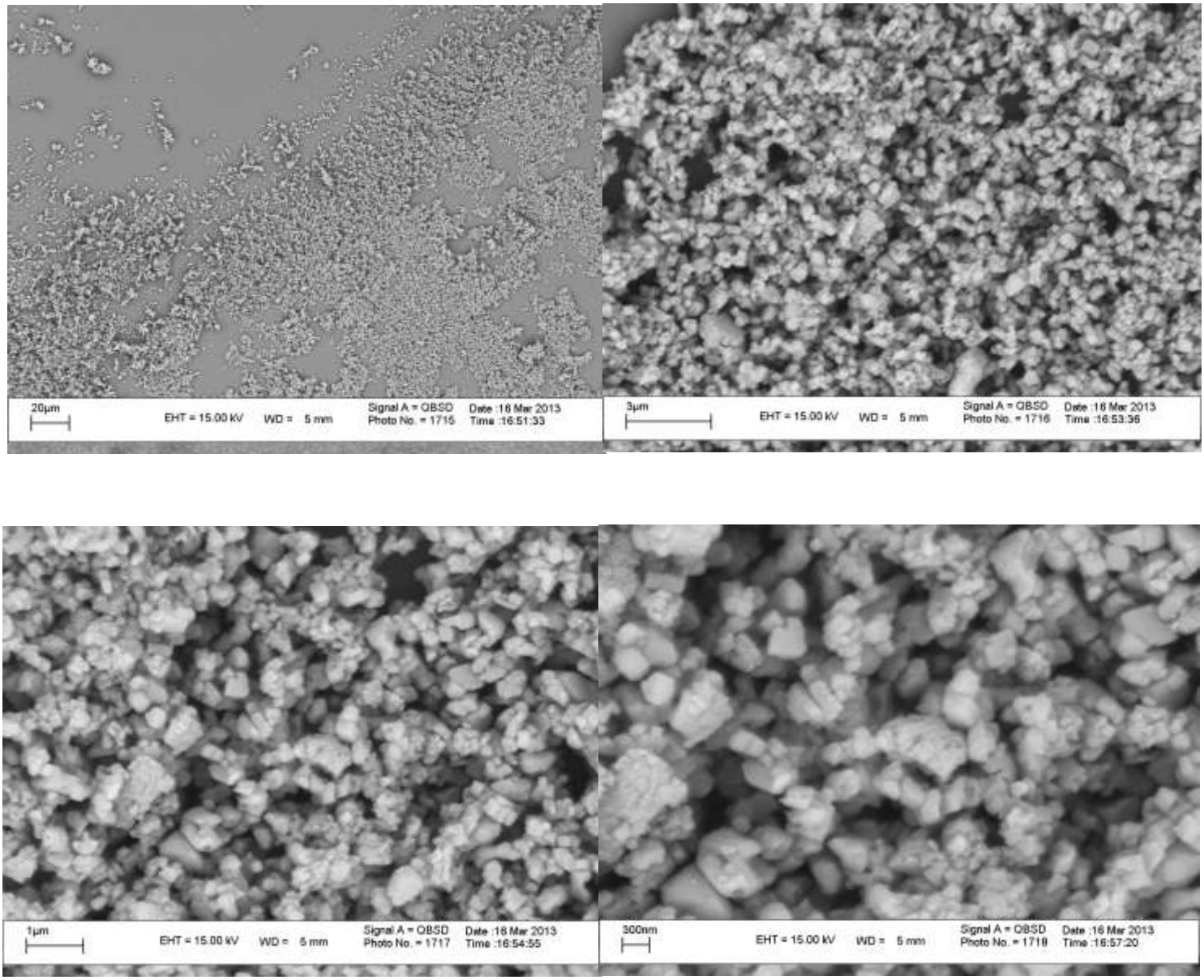


Figure S12. SEM images of $CaMnO_3$ after treating with Ce(IV) (1.8 M, for one month).

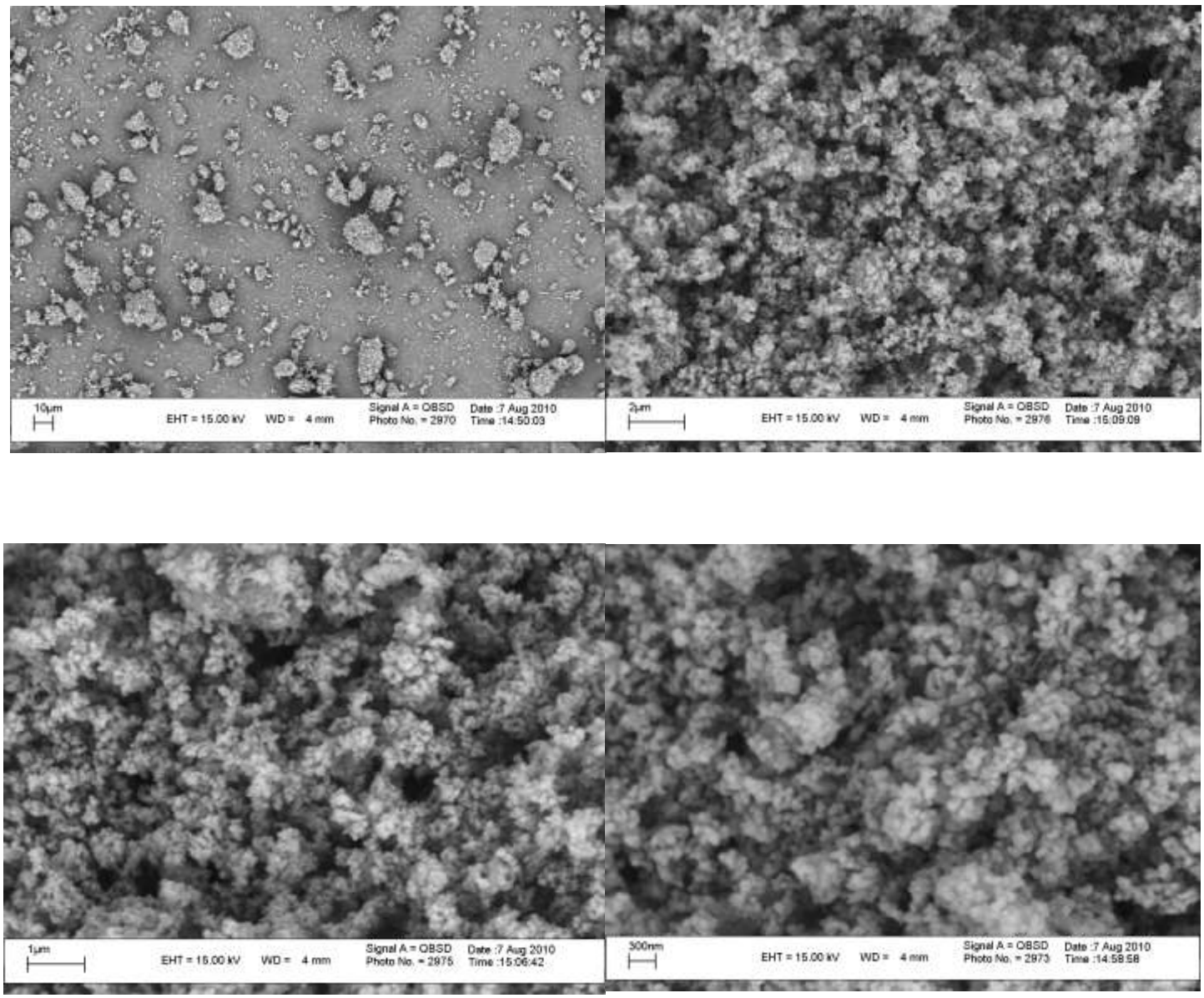


Figure S13. SEM images of Mn_2O_3.

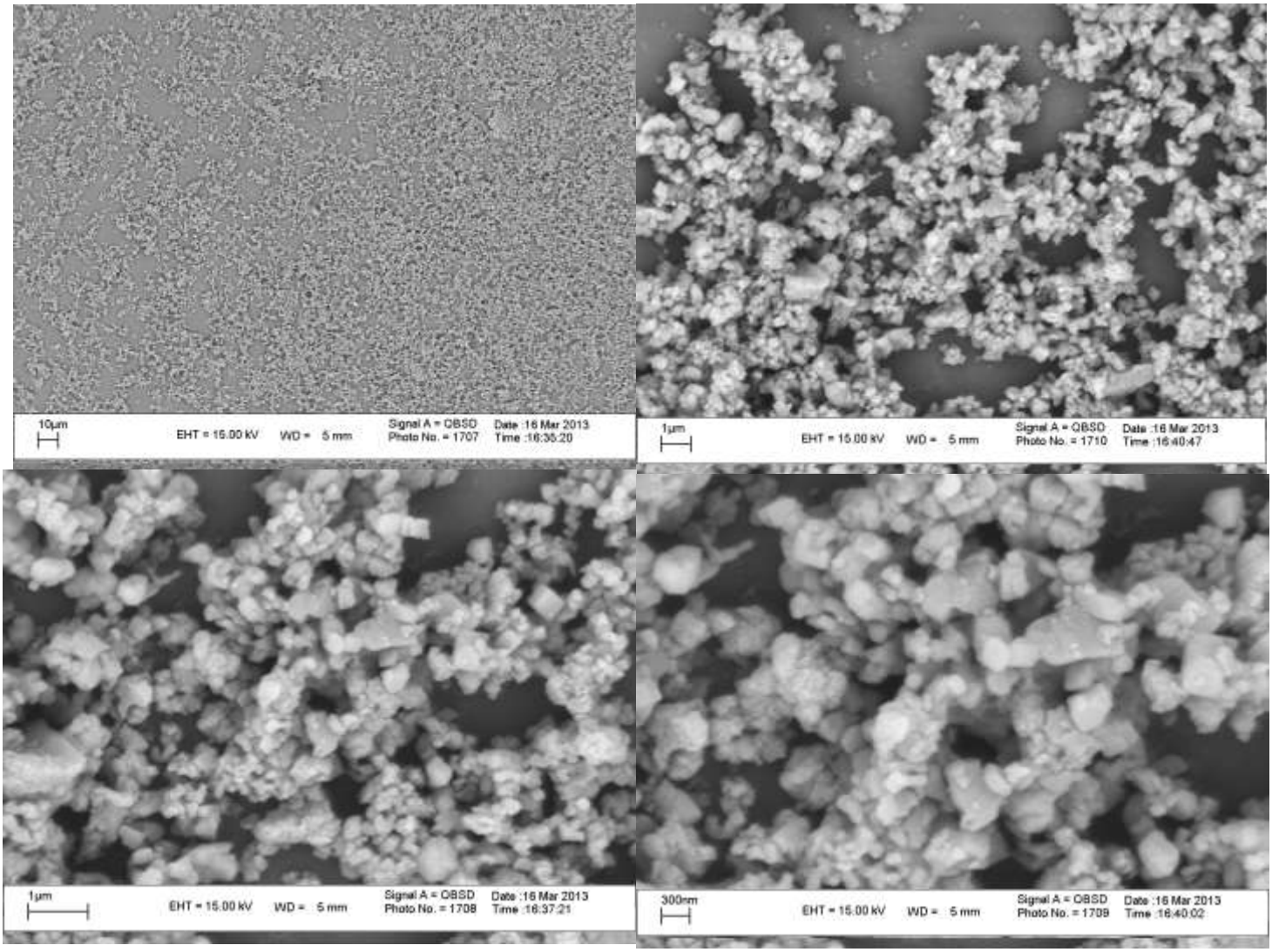


Figure S14. SEM images of Mn_2O_3 after treating with Ce(IV) (1.8 M, for one month).

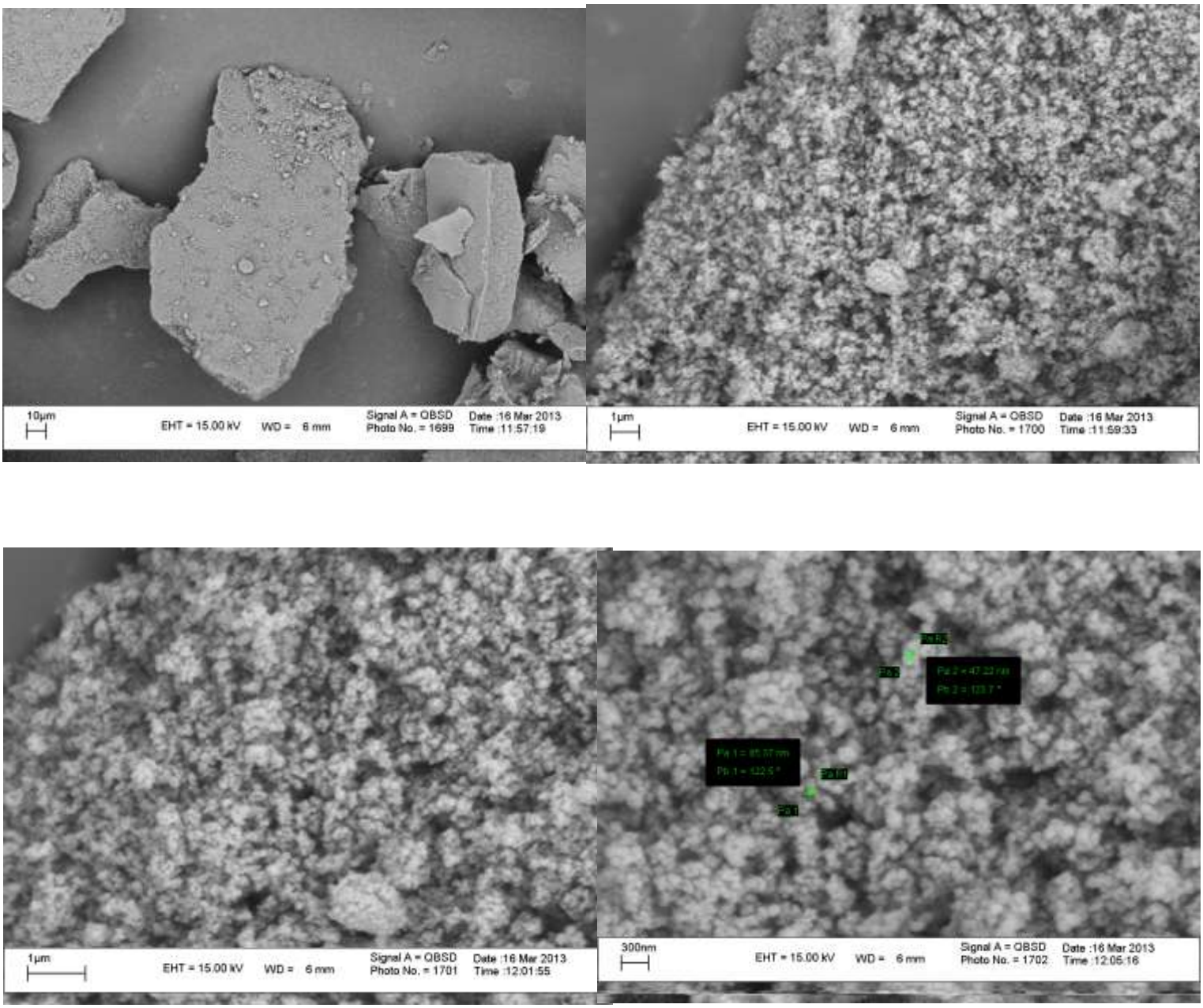


Figure S15. SEM images of Mn_3O_4.

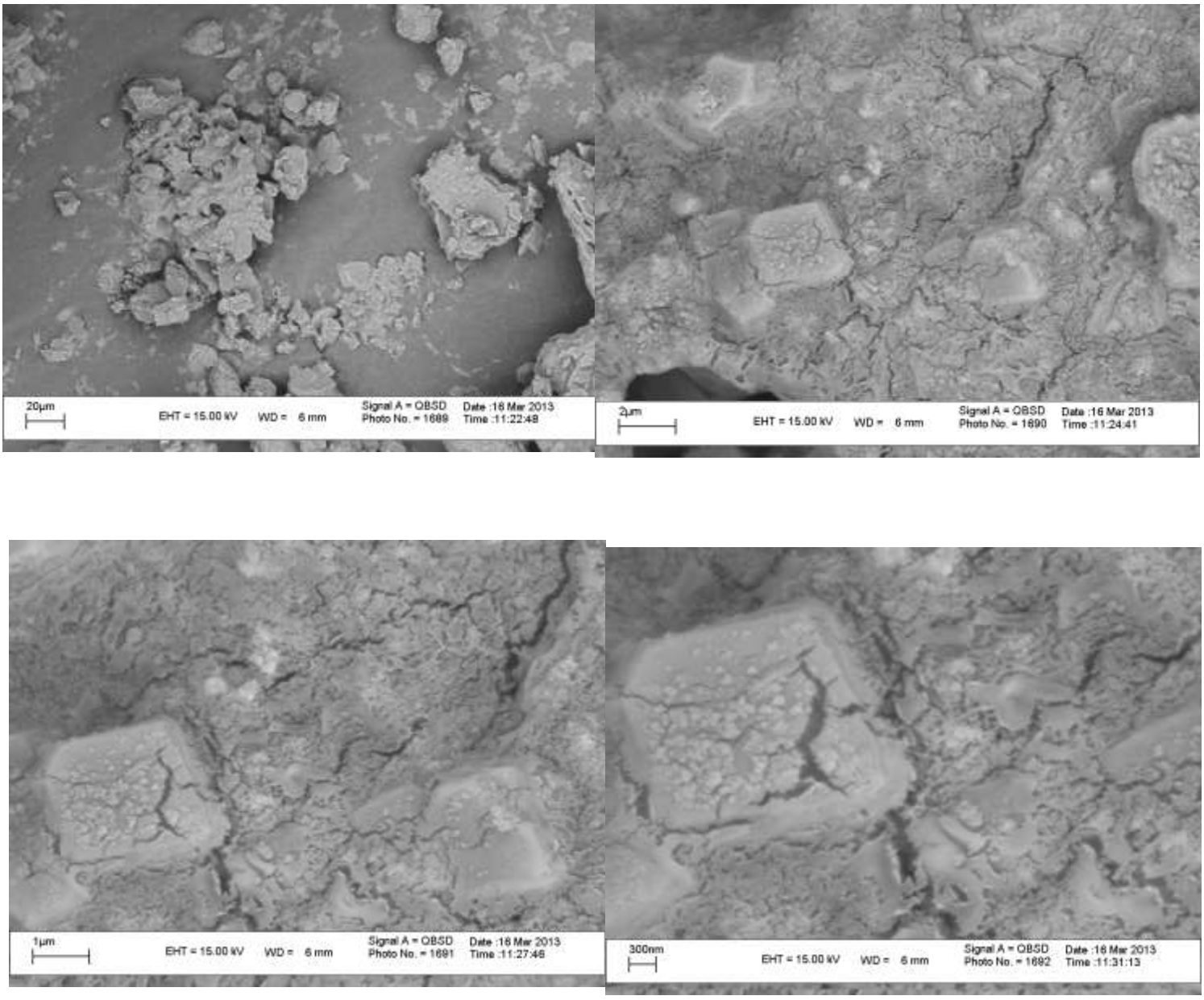


Figure S16. SEM images of Mn_3O_4 after treating with Ce(IV) (1.8 M, for one month).

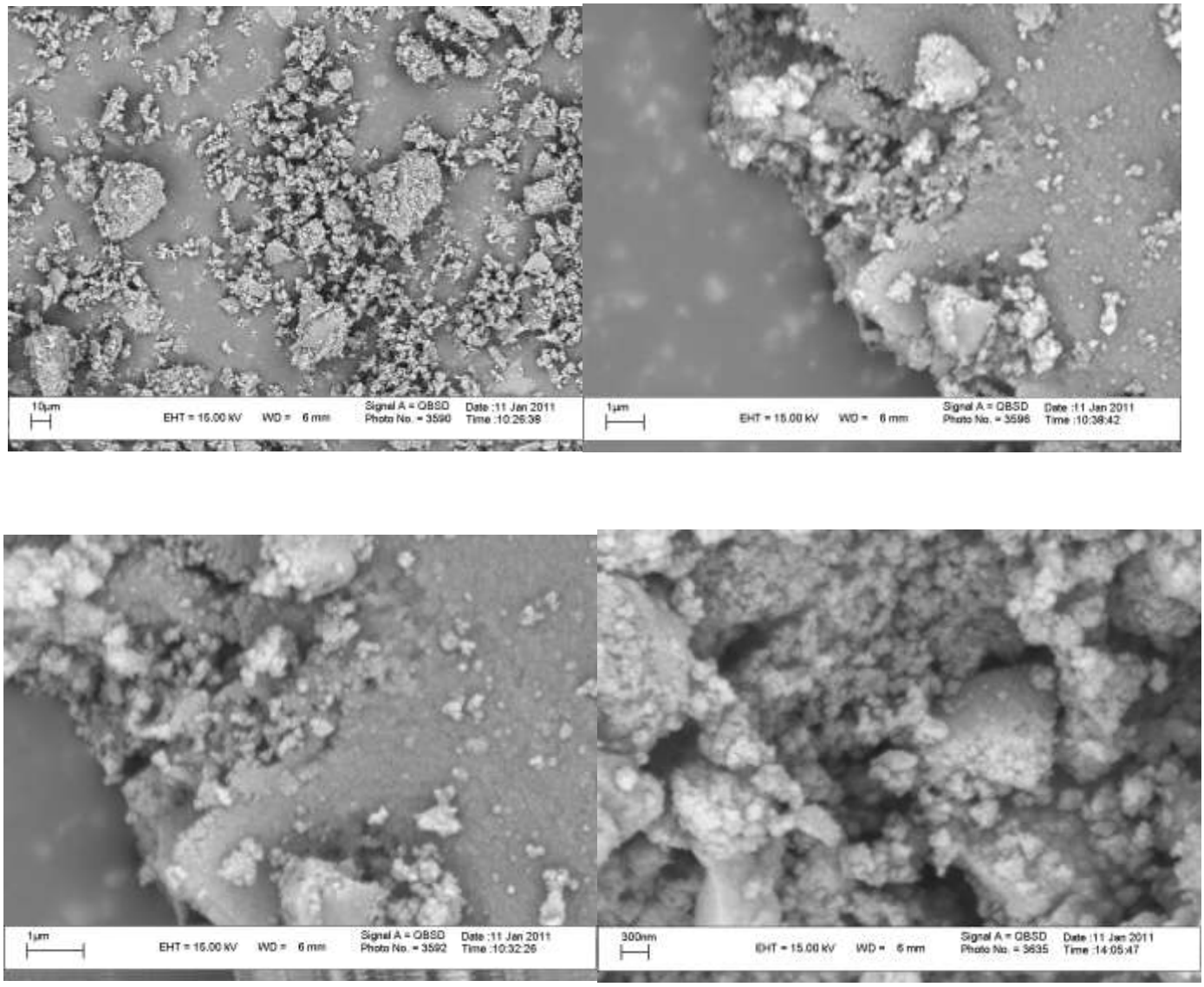


Figure S17. SEM images of layered Mn Oxide.

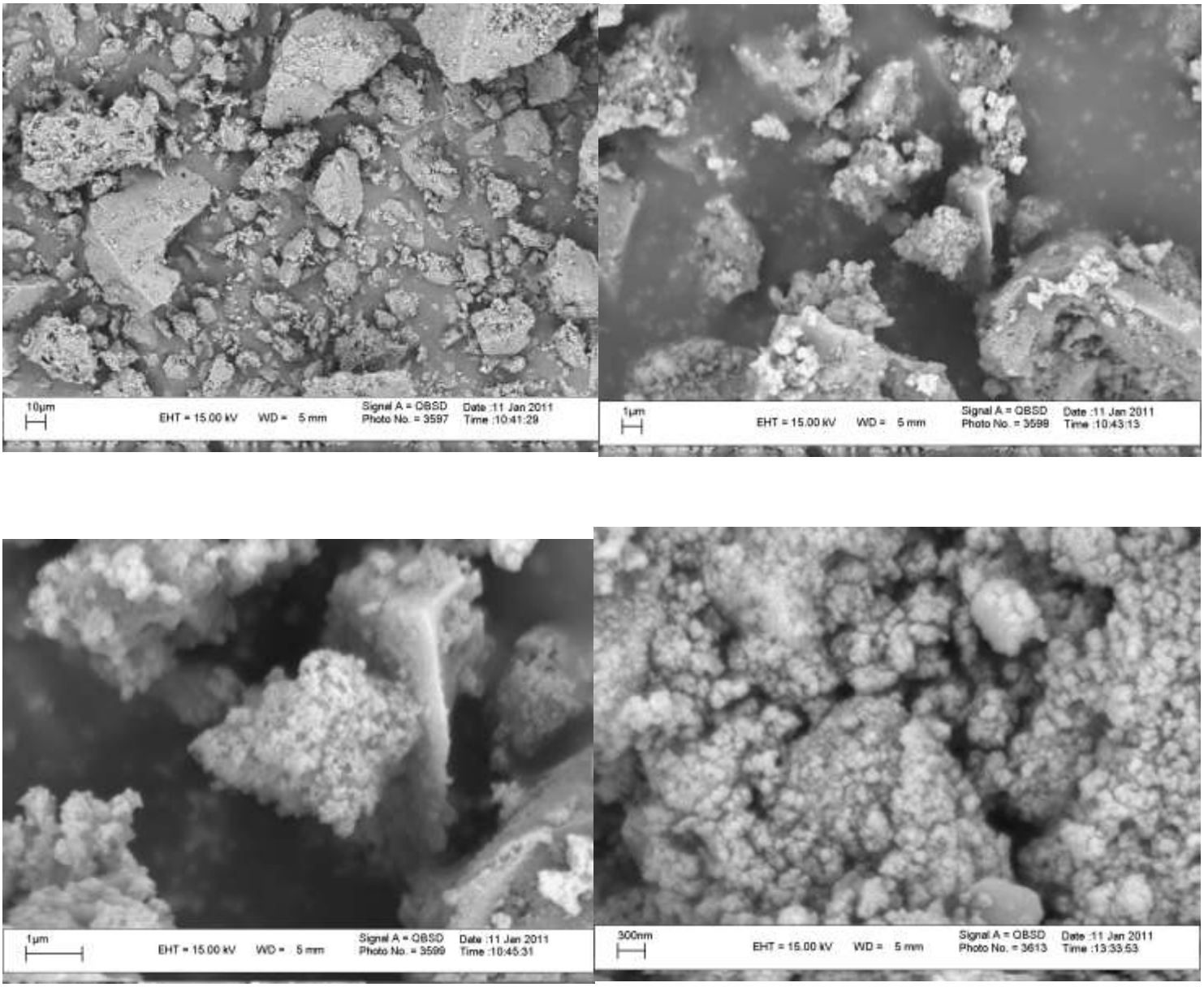
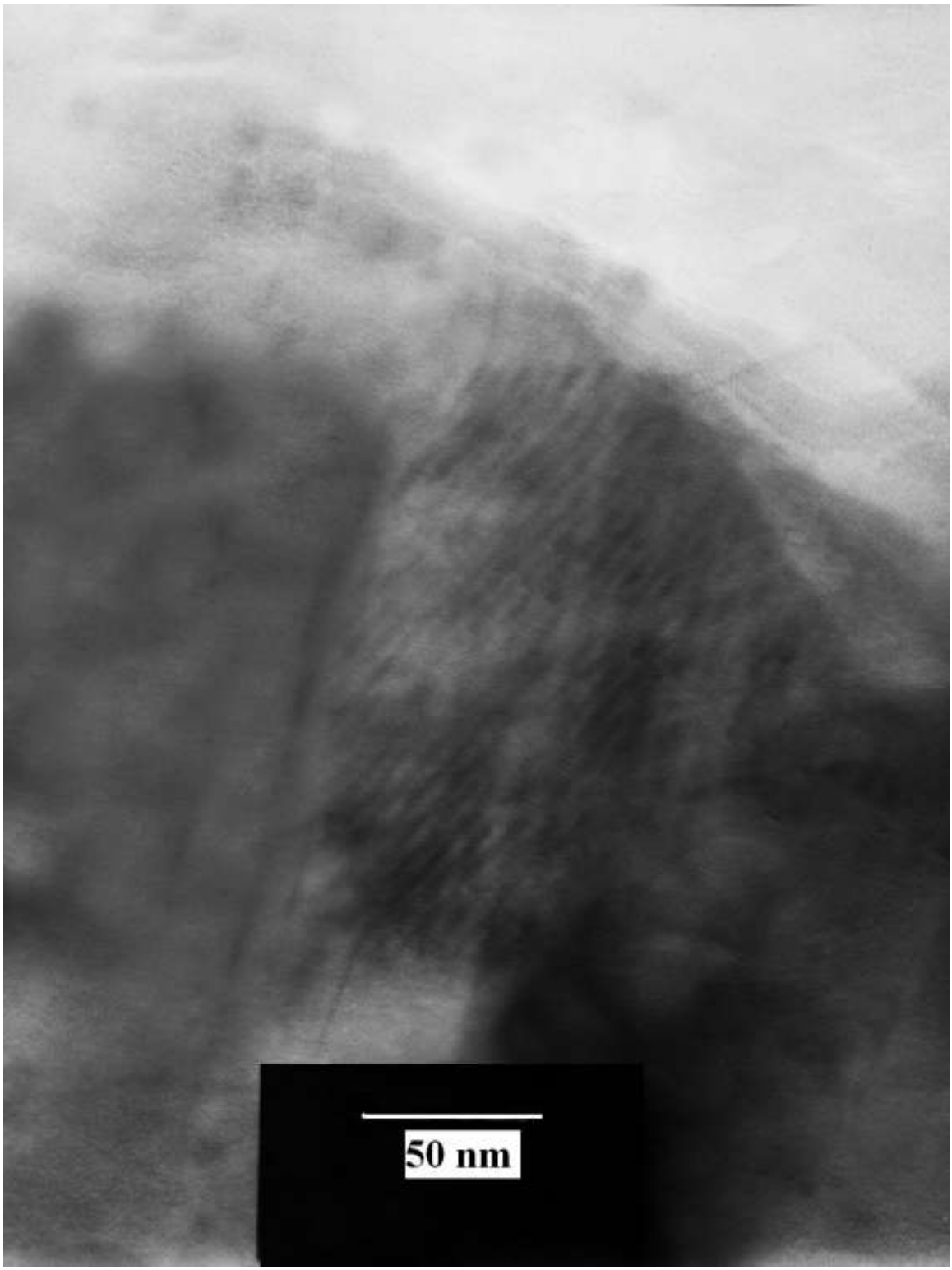
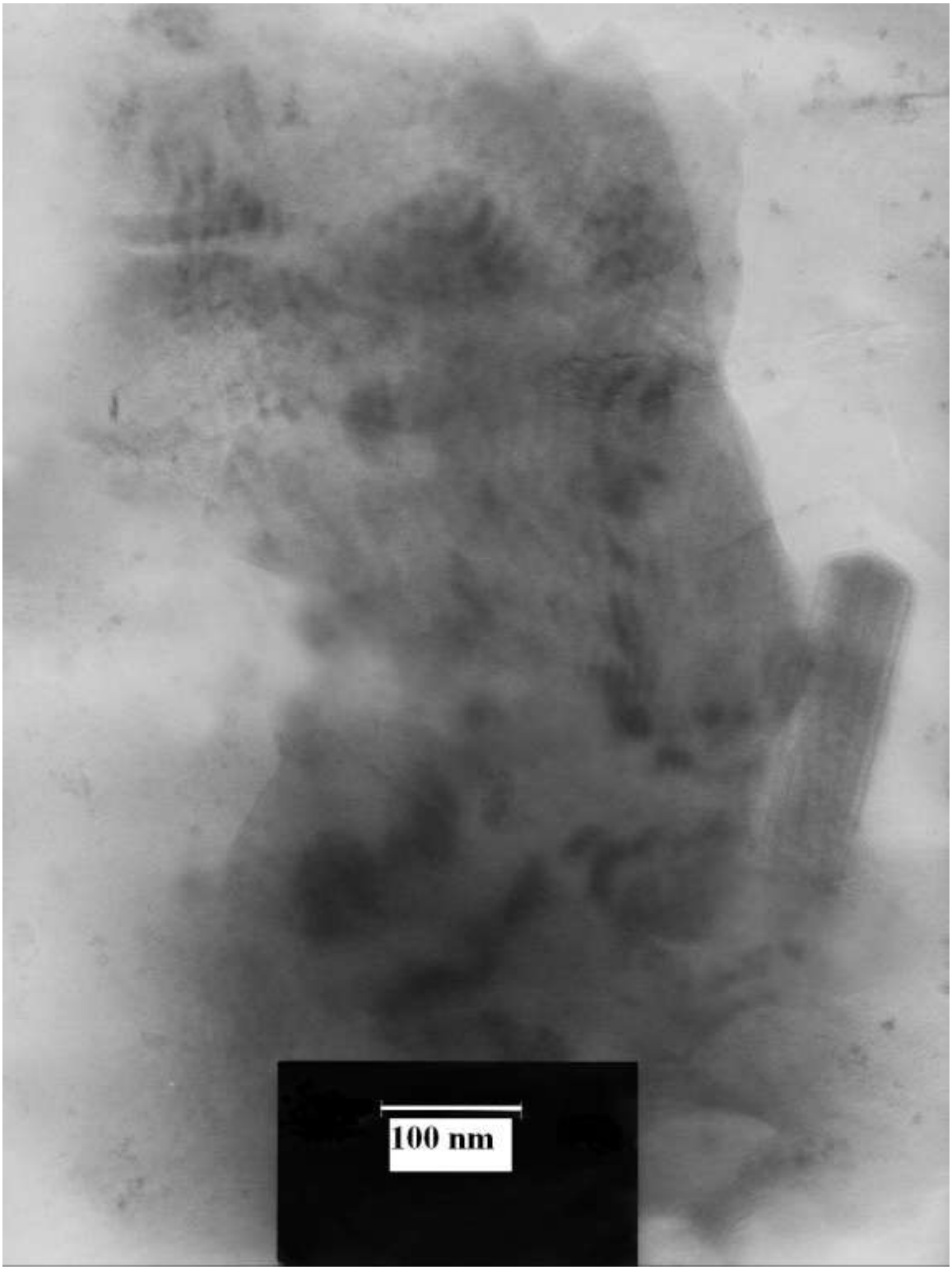


Figure S18. SEM images of layered Mn oxide after treating with Ce(IV) (1.8 M, for one month).

a



b



c

Figure S19. TEM images of layered Mn oxide after treating with Ce(IV) (1.8 M, for one month) (a-c).