

Support Information

Facile Synthesis of Homogeneous Cs_xWO₃ Nanorods with Excellent Low-emissivity and NIR Shielding Property by a Water Controlled-Release Process

Chongshen Guo^{a*}, Shu Yin^a, Mei Yan^b, Tsugio Sato^a

^a Institute of Multidisciplinary Research for Advanced Materials ,Tohoku University, 2-1-1

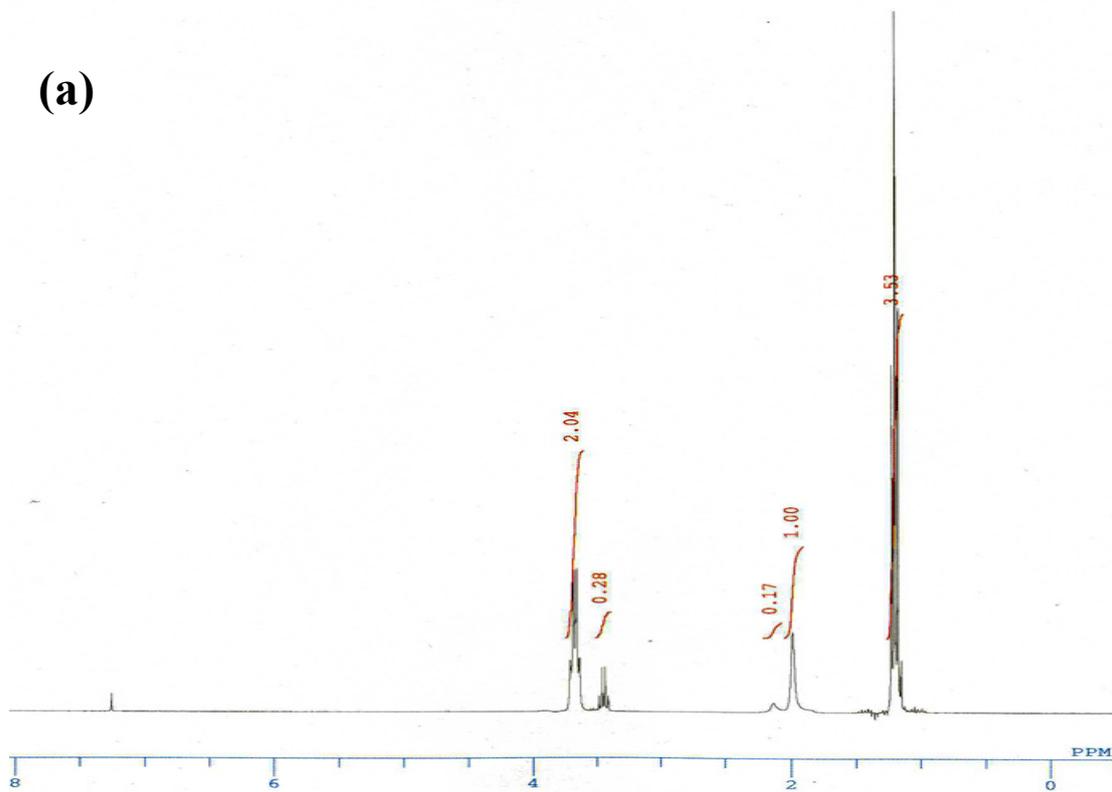
Katahira, Aoba-ku ,Sendai, 980-8577, Japan

Tel. &Fax: +81 222175598 E-mail: bigguop@mail.tagen.tohoku.ac.jp

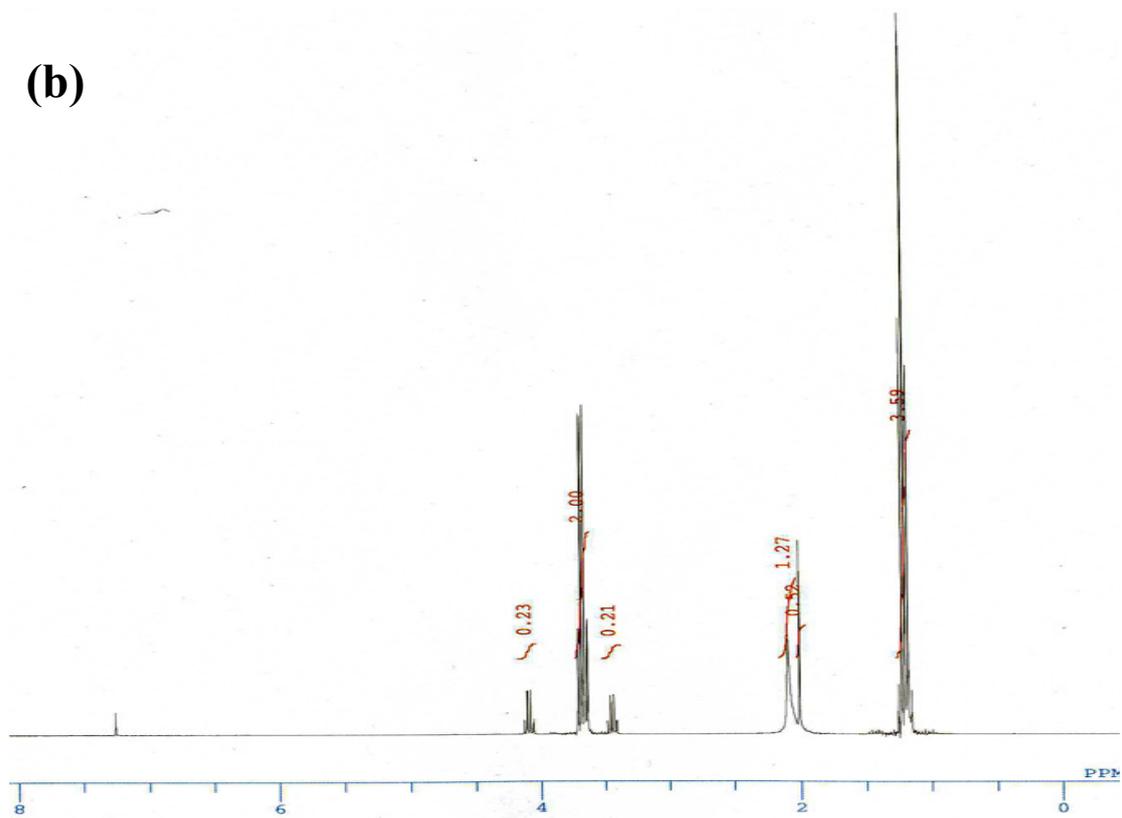
^b Department of Chemistry, Graduate school of Science, Tohoku University, Aoba-ku, Sendai ,

Japan

(a)



(b)



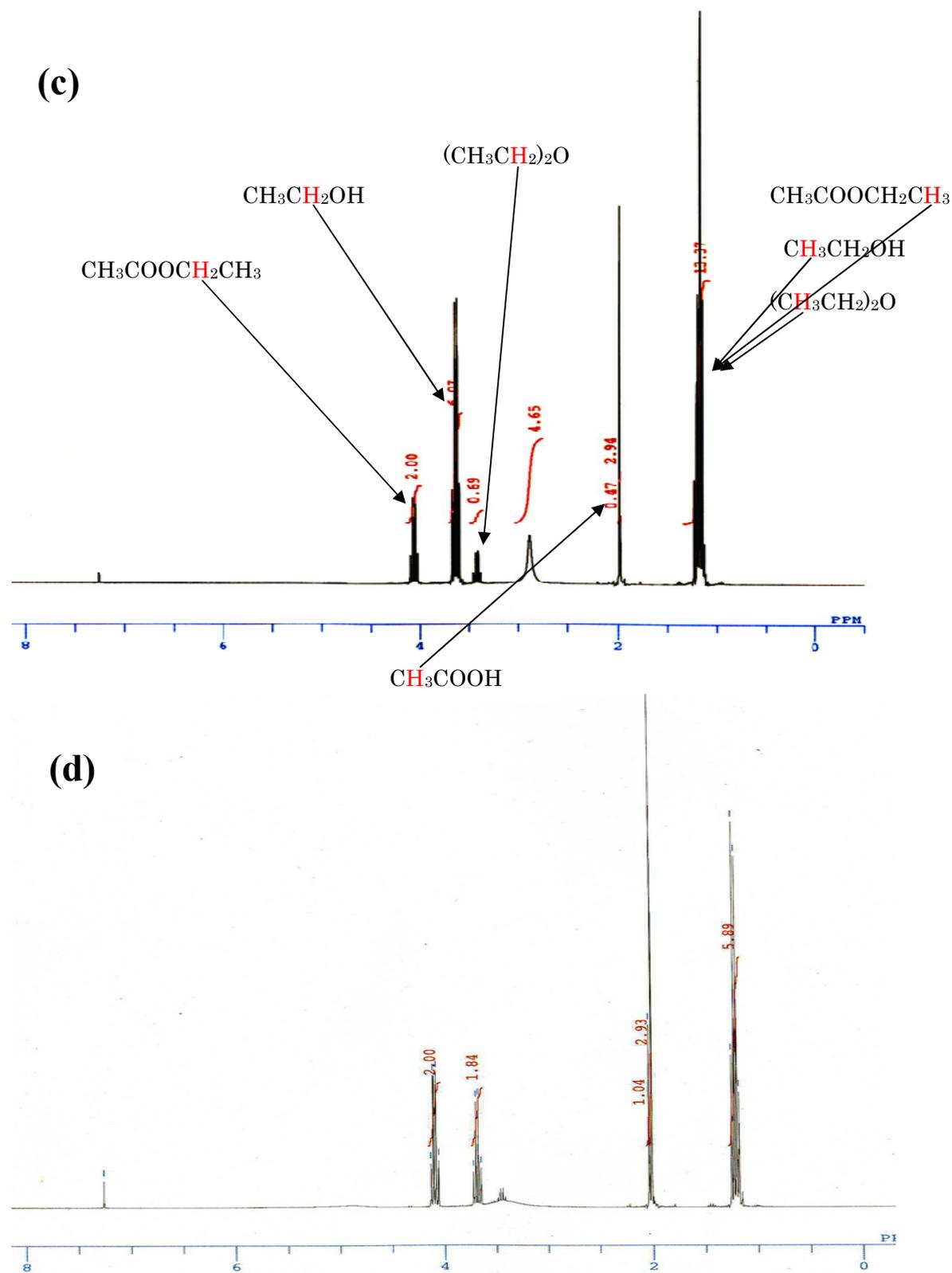
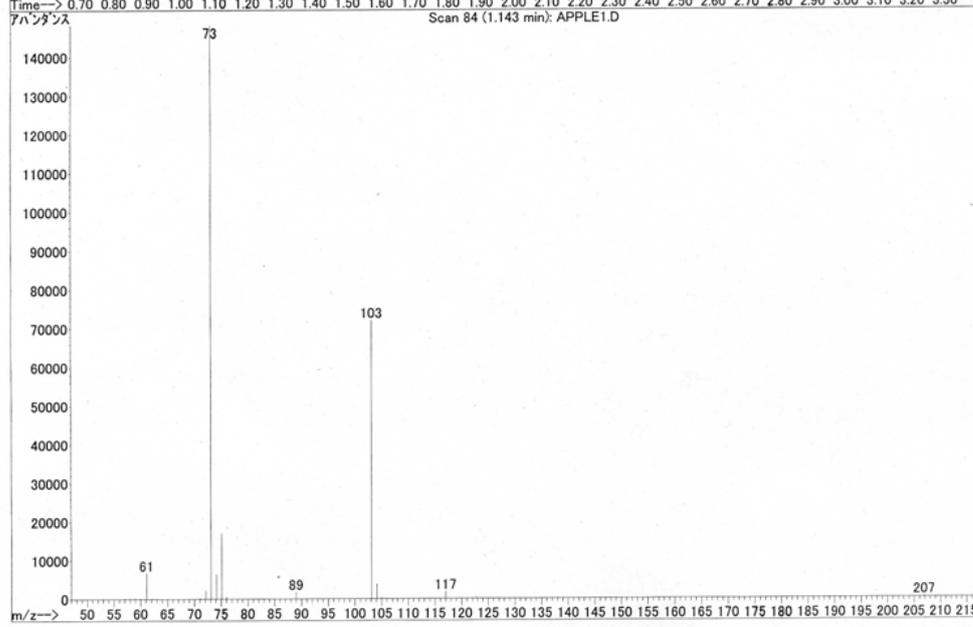
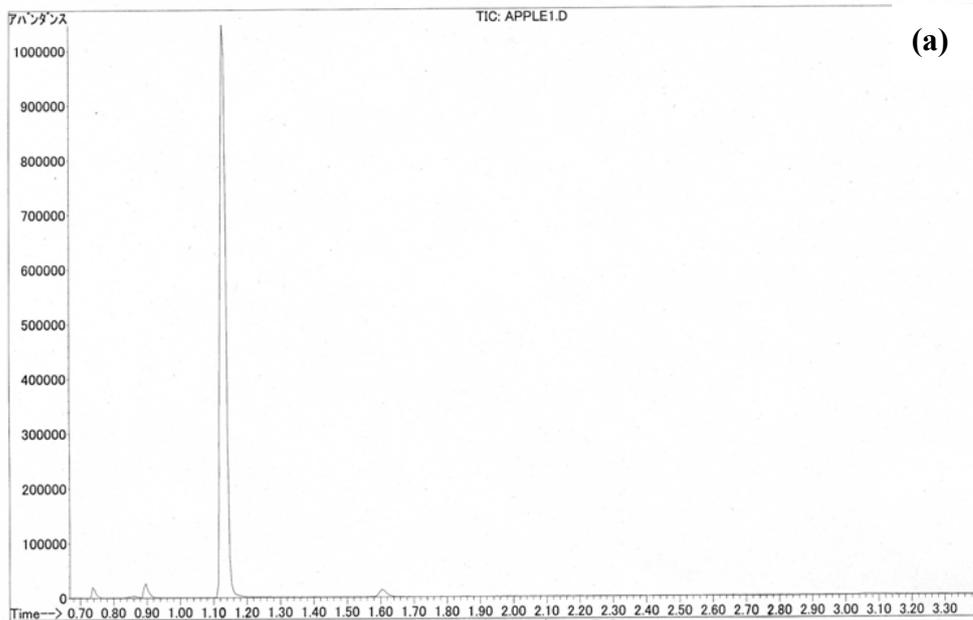
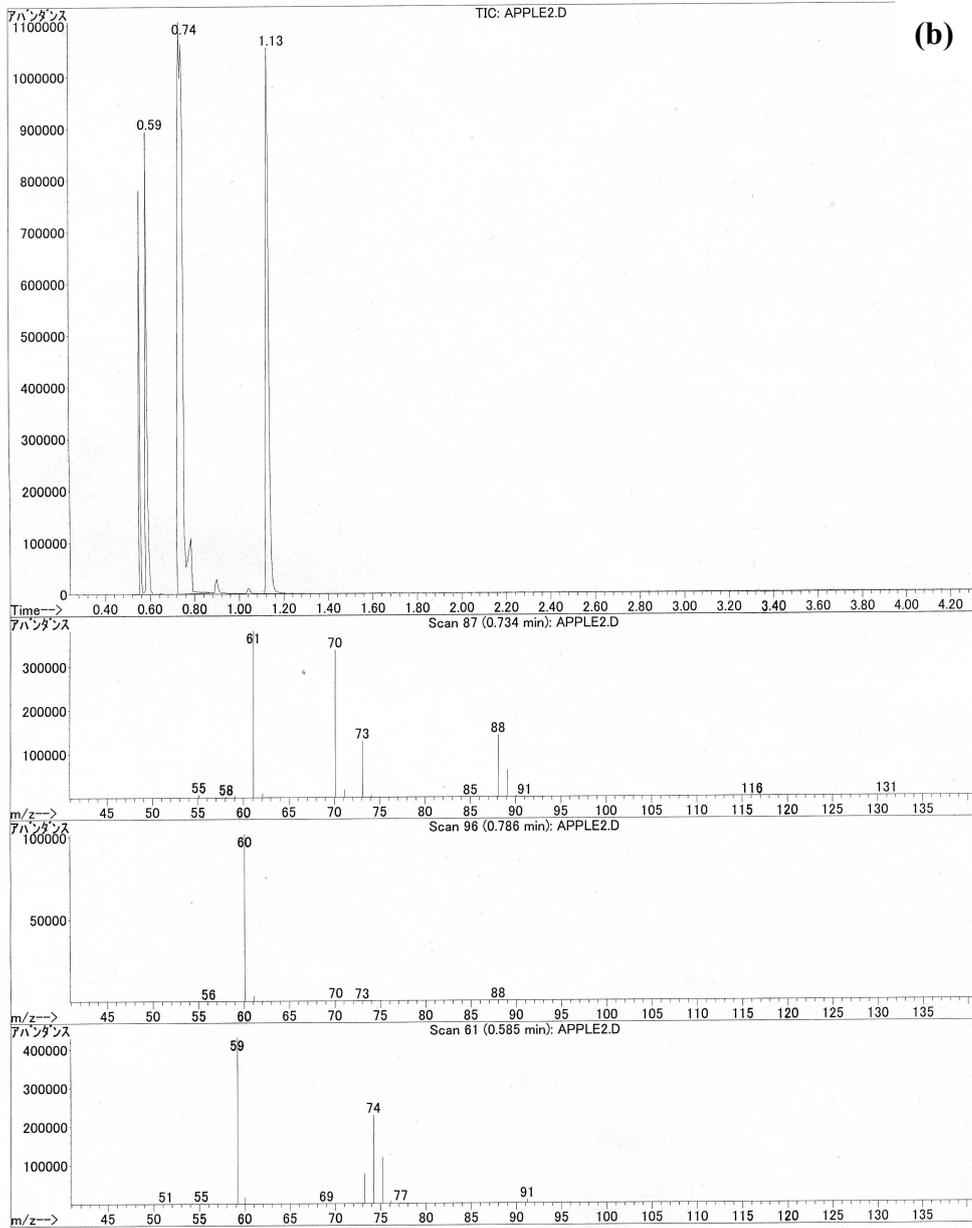
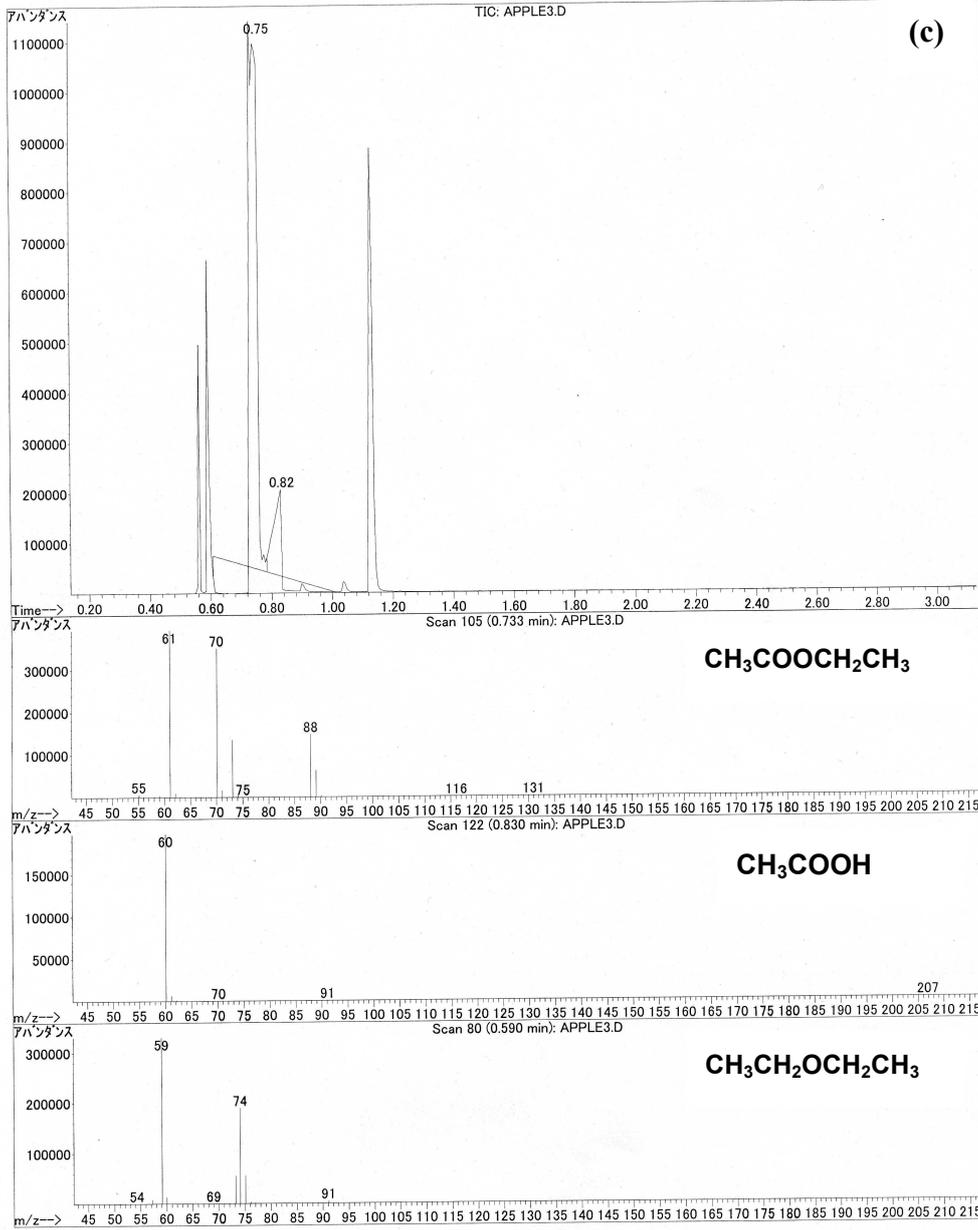


Fig.S-1 NMR spectra of solvents after solvothermal reaction. Taking of (a) 50ml ethanol (b) 50ml 10 Vol.% acetic acid in ethanol (c) 50ml 20 Vol.% acetic acid in ethanol (d) 50ml 40 Vol.% acetic acid in ethanol as starting solution.(The origin of peaks in the NMR spectra were marked in Fig.S-1c; It is well known that water don't has a fixed position in the NMR spectra.)







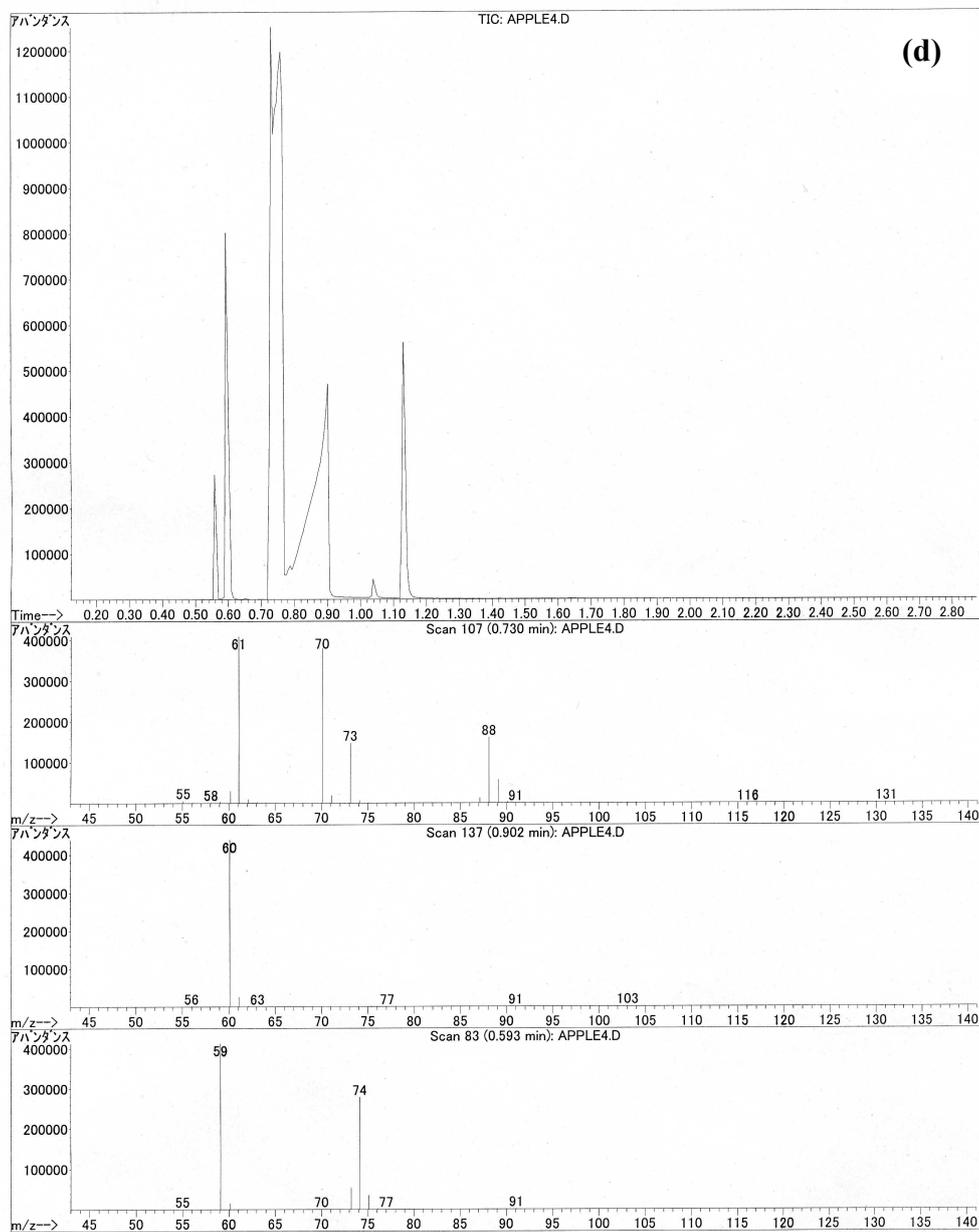


Fig.S-2 GC-MS spectra of solvents after solvothermal reaction. Taking of (a) 50ml ethanol (b) 50ml 10 Vol.% acetic acid in ethanol (c) 50ml 20 Vol.% acetic acid in ethanol (d) 50ml 40 Vol.% acetic acid in ethanol as starting solution (Before GC-MS measurement, H₂O in the solution was removed as water has a negative effects on the equipment.)

Table.S-1 The amount of species calculated from the NMR spectra

Species Vol.% AC	Ethanol/mol	Acetic acid/mol	Ethyl acetate/mol	Ethylether / mol	H ₂ O from Eq(1) /g	H ₂ O Eq(2) / g
0	0.75295	0	0	0.05167	0	0.93
10	0.6291	0.010466	0.07696	0.03145	1.3853	0.5661
20	0.4692	0.02276	0.1521	0.02956	2.738	0.53
40	0.2541	0.09	0.2597	-	4.675	0

* Eq (1): $\text{CH}_3\text{CH}_2\text{OH} + \text{CH}_3\text{COOH} = \text{CH}_3\text{CH}_2\text{OOCCH}_3 + \text{H}_2\text{O}$

Eq(2): $\text{CH}_3\text{CH}_2\text{OH} + \text{CH}_3\text{COOH} = \text{CH}_3\text{CH}_2\text{OOCCH}_3 + \text{H}_2\text{O}$

“-” The signal area was too weak to be integrated.

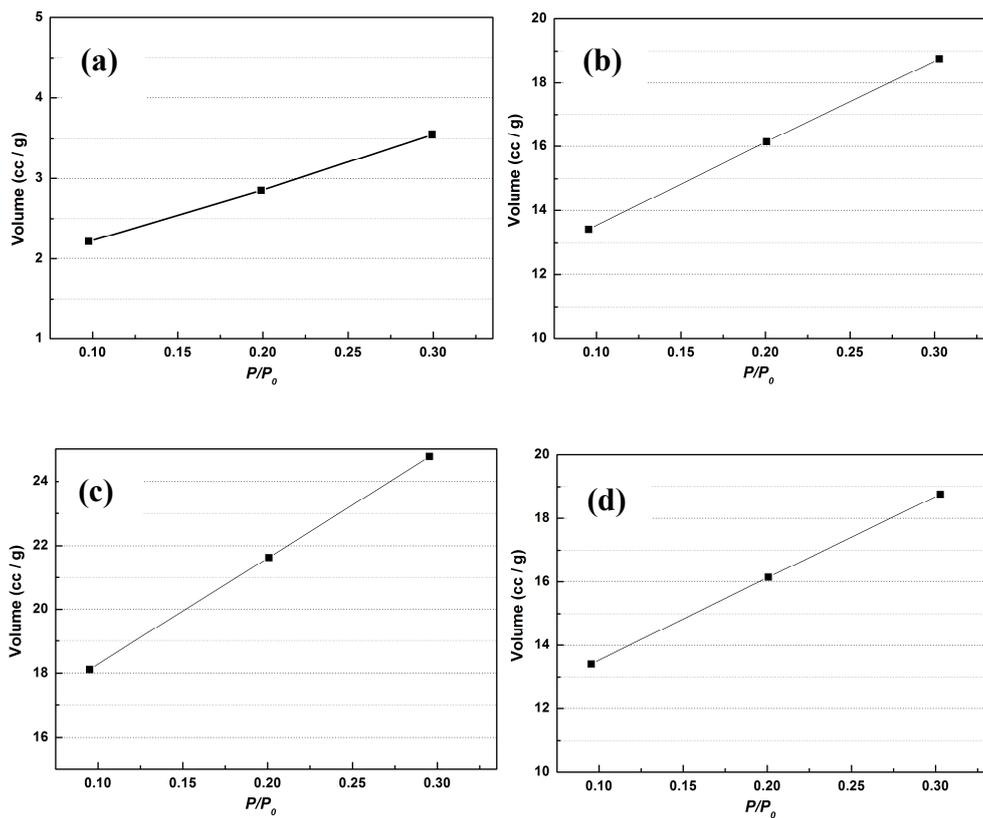


Fig.S-3 The BET plots of Cs_xWO_3 particles synthesized in (a) pure ethanol and ethanol-acetic acid mixed solutions containing (b) 10 vol.% (c) 20 vol.% (d) 40 vol.% acetic acid at 240°C for 20 h with a nominal Cs/W atomic ratio of 0.5

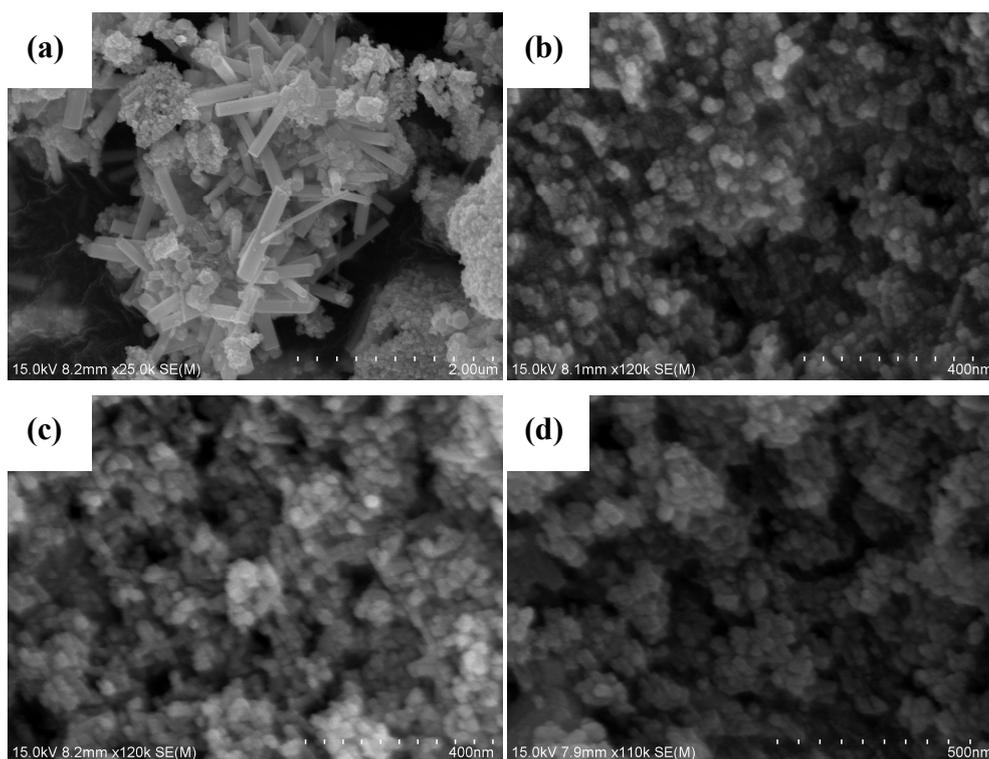


Fig.S-4 The SEM images of Cs_xWO_3 particles synthesized in (a) pure ethanol and ethanol-acetic acid mixed solutions containing (b) 10 vol.% (c) 20 vol.% (d) 40 vol.% acetic acid at 240°C for 20 h with a nominal Cs/W atomic ratio of 0.5.

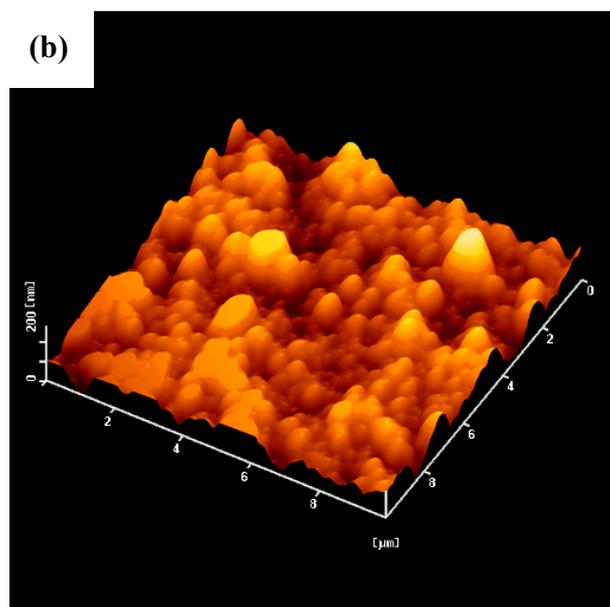
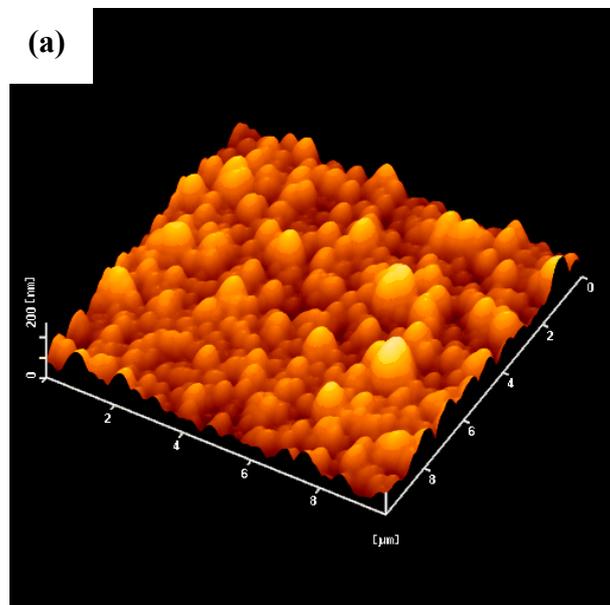


Fig.S-5 The AFM images of (a) ITO glass and (b) ITO coated by the Cs_xWO_3