Supplementary Information

Table S1. Surface composition of MoO_3 synthesized via a block copolymer templating method analyzed by XPS [a].

Mo_{oxid} [b] /at.%	O_{oxid} [b] /at.%	O_{cont} [c] /at.%	C_{cont} [c] /at.%	Cl_{cont} [c] /at.%	O/Mo [d]
13.1	23.8	12.3	47.5	3.2	2.8

[a] Measurements done without Ar sputtering; [b] Oxides; [c] Contaminants, meaning that elements are not associated with oxide phases; [d] O/Mo ratio of surface oxide phases.

Table S2. Surface composition of Ru/C catalysts analyzed by XPS [a].

Catalyst	Ru /at.%	C /at.%	O /at.%	Na /at.%	Mo /at.%
Ru/C fresh	4.2	86.2	7.6	2.0	0.1
Ru/C aged	1.9	92.3	3.4	0.3	0.2

[a] Measurements done after Ar sputtering.

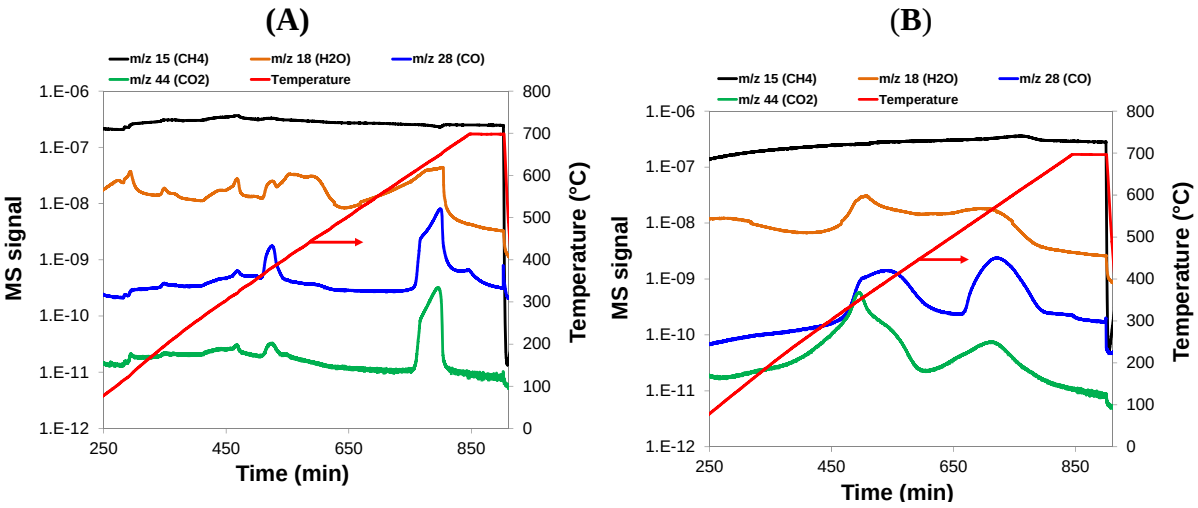


Figure S1. Gas concentration profiles measured with a mass spectrometer during temperature-programmed carburization of (**A**) $(NH_4)_6Mo_7O_{24}{\cdot}4H_2O$, and (**B**) MoO_3 synthesized via a block copolymer templating method.

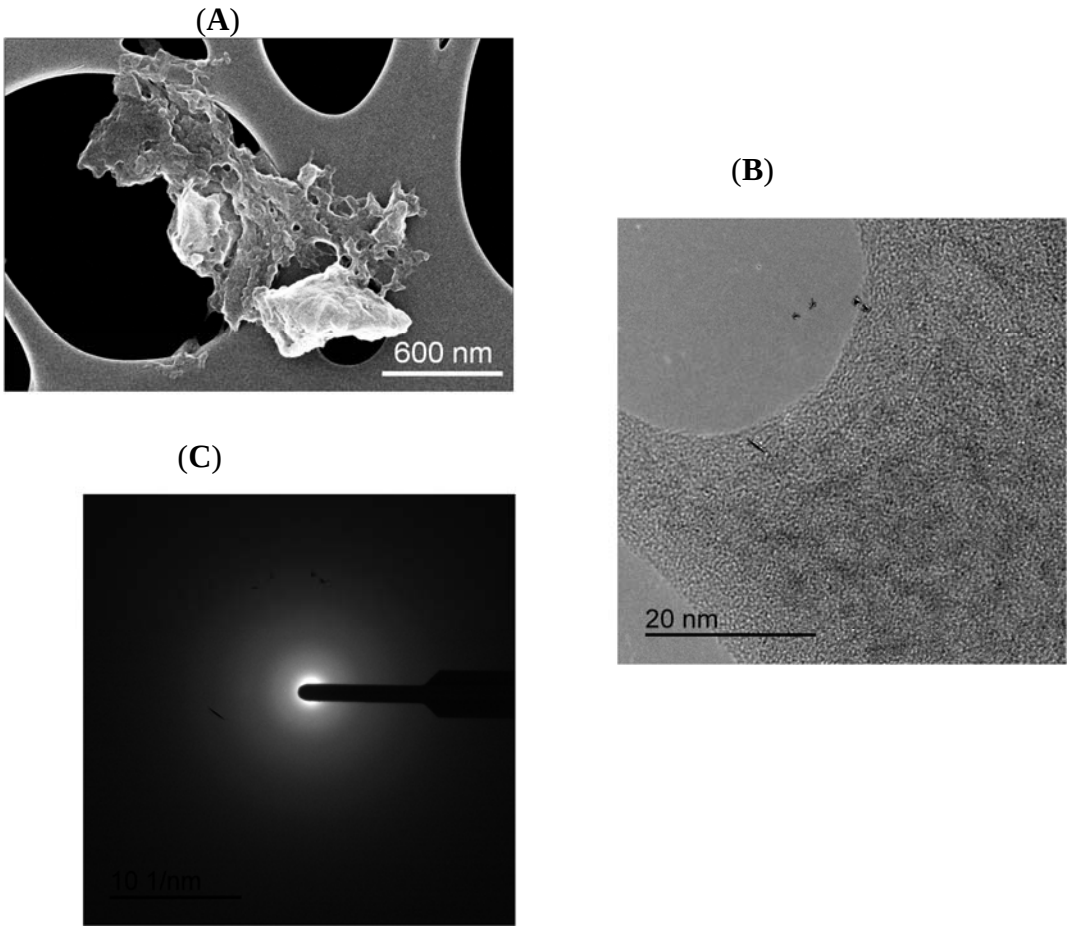


Figure S2. Electron microscopy analysis of MoO_3 precursor (synthesized via a block-copolymer templating method) used for Mo_2C-B synthesis: (A) SEM image, (B) TEM image, and (C) electron microdiffraction pattern.

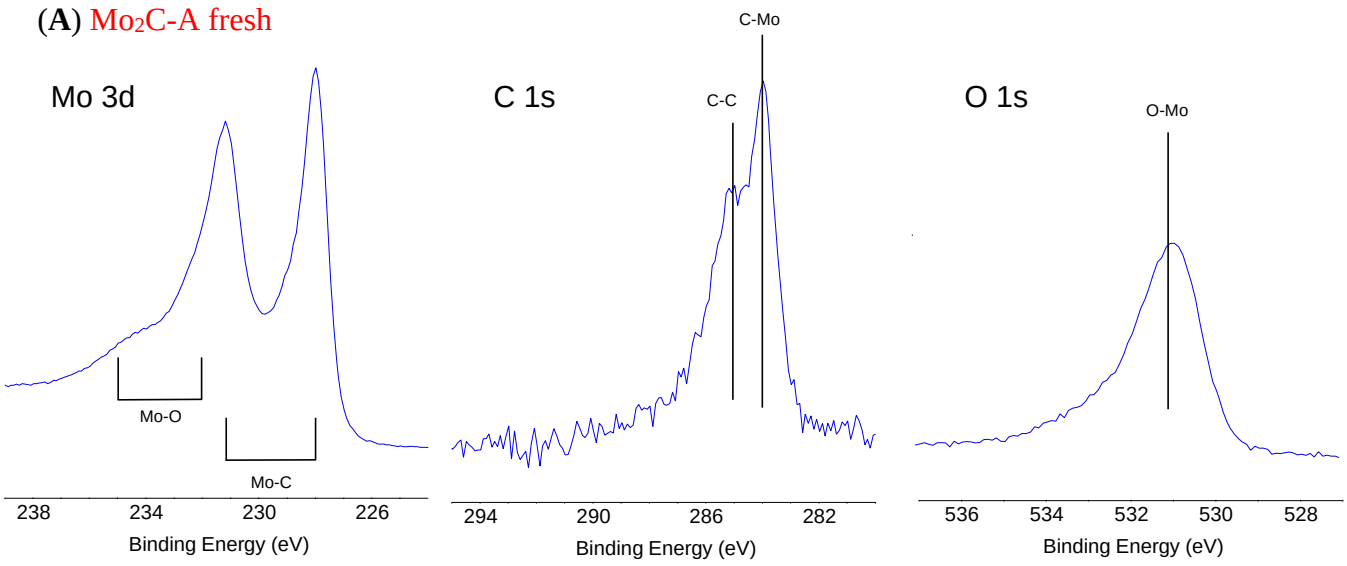
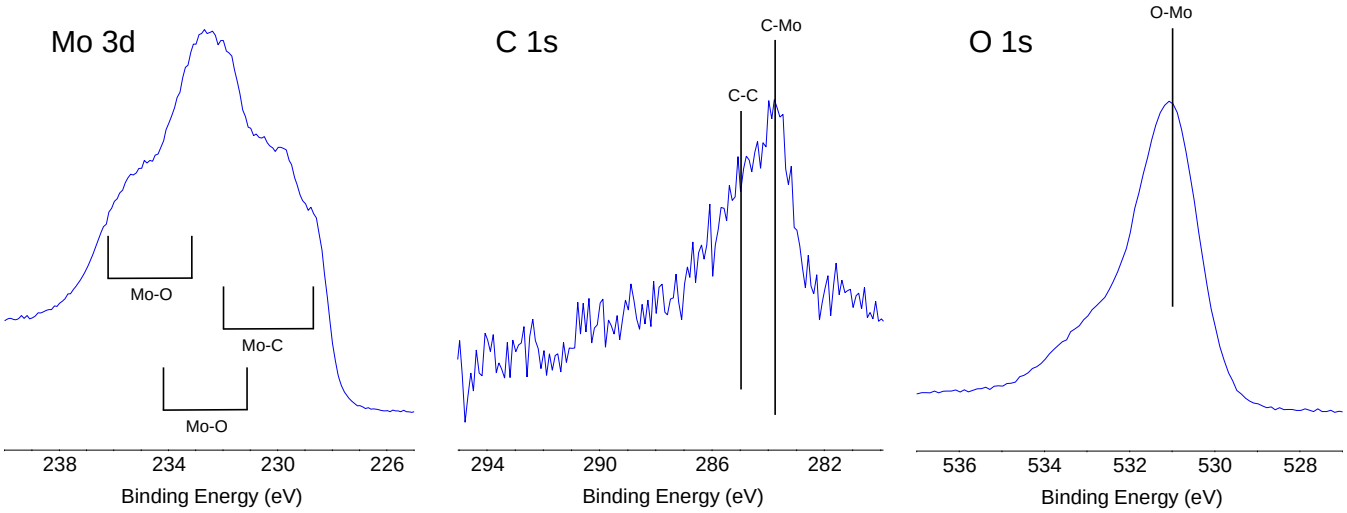
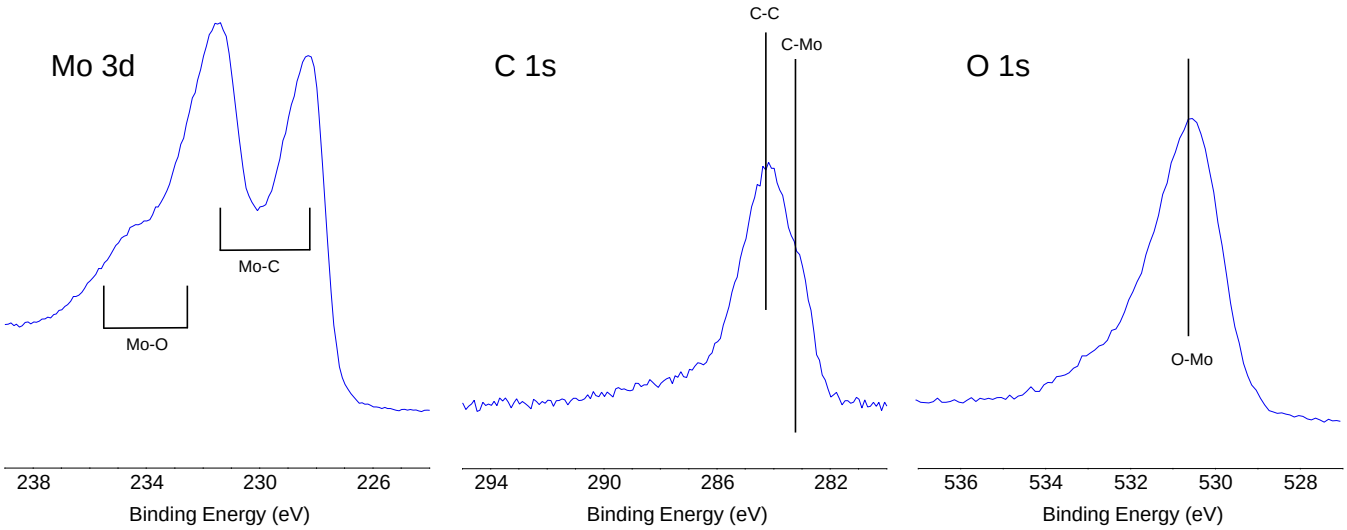


Figure S3. *Cont.*

(**B**) Mo_2C-A aged



(**C**) Mo_2C-A tested



(**D**) Mo_2C-B fresh

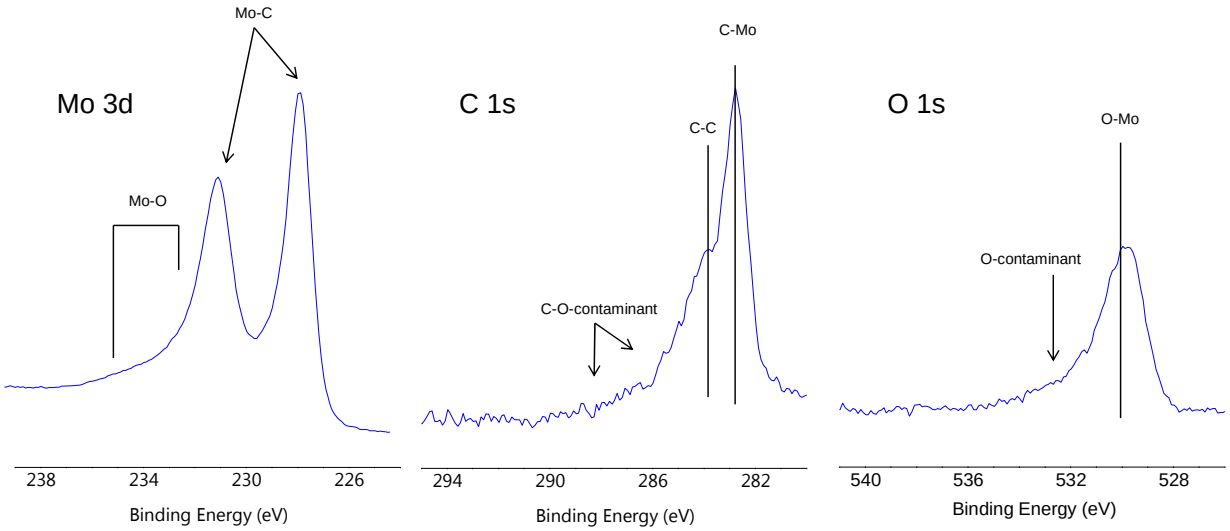


Figure S3. *Cont.*

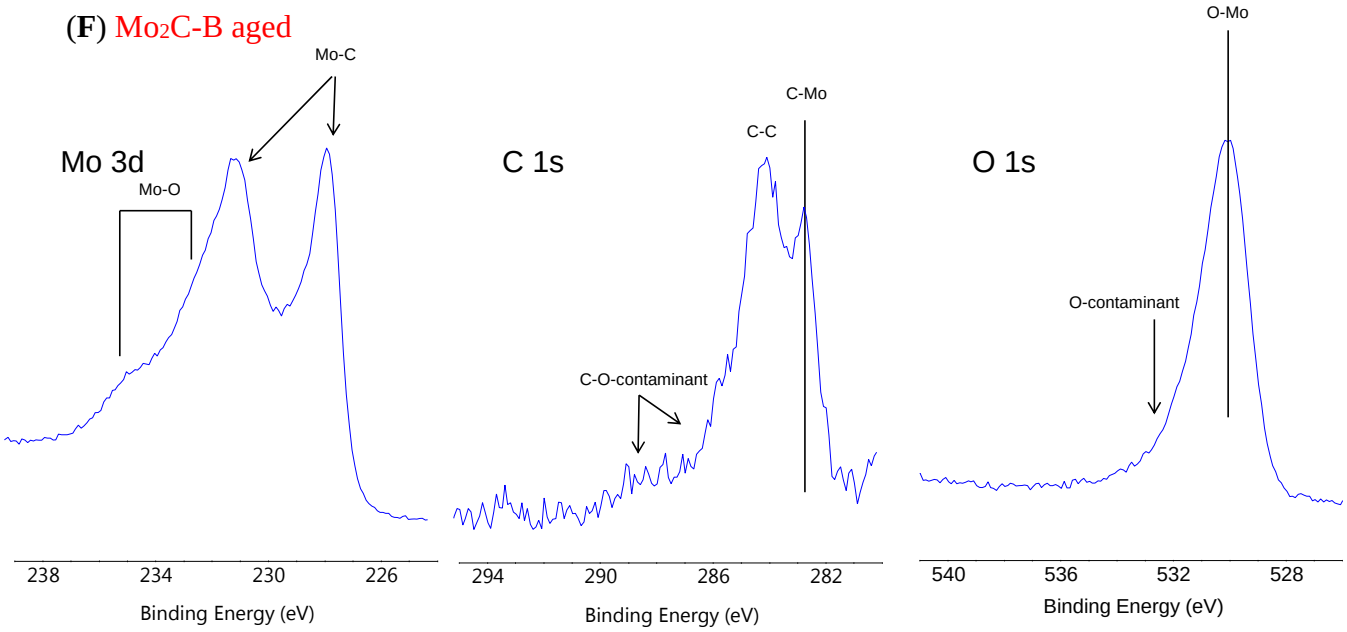


Figure S3. XPS spectra at Mo 3d, C 1s and O 1s for Mo_2C catalysts. (**A**) Mo_2C-A fresh; (**B**) Mo_2C-A aged; (**C**) Mo_2C-A tested; (**D**) Mo_2C-B fresh; (**F**) Mo_2C-B aged.

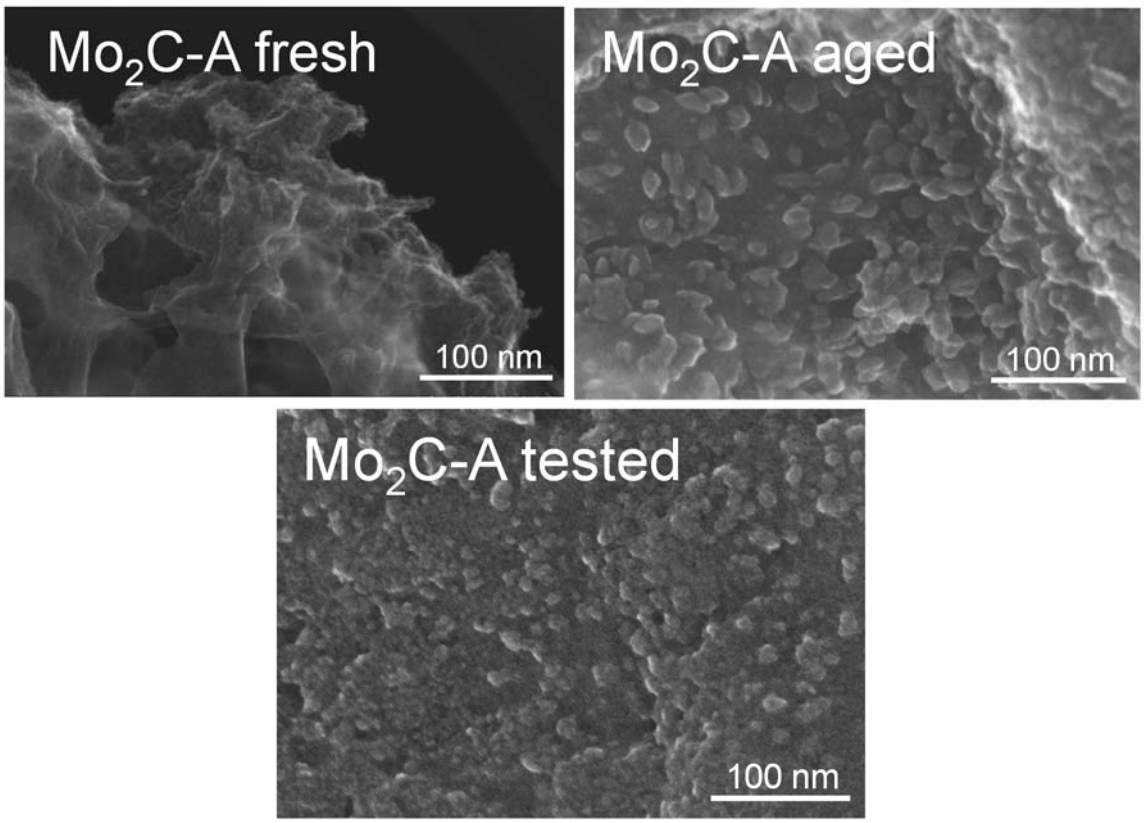


Figure S4. SEM images of Mo_2C-A in the fresh state, after aging for 48 h at 250 °C in liquid water, and after a 48-h aqueous-phase hydroprocessing run (10% guaiacol in water as feed) at 250 °C.

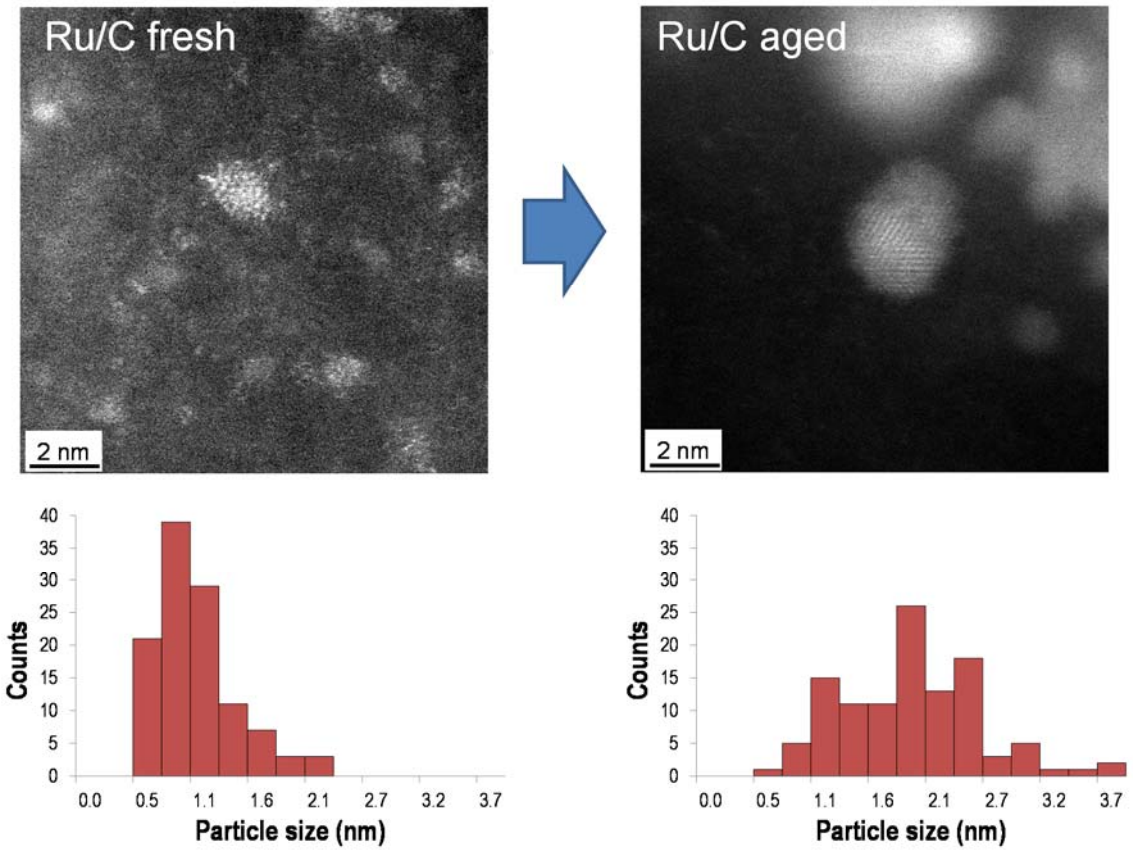


Figure S5. TEM images and Ru particle size distributions obtained before and after aging of Ru/C for 48 h at 250 °C in liquid water.