

Supplementary materials

Exploration of the Cs Trapping Phenomenon by Combining Graphene Oxide with α -K₆P₂W₁₈O₆₂ as Nanocomposite

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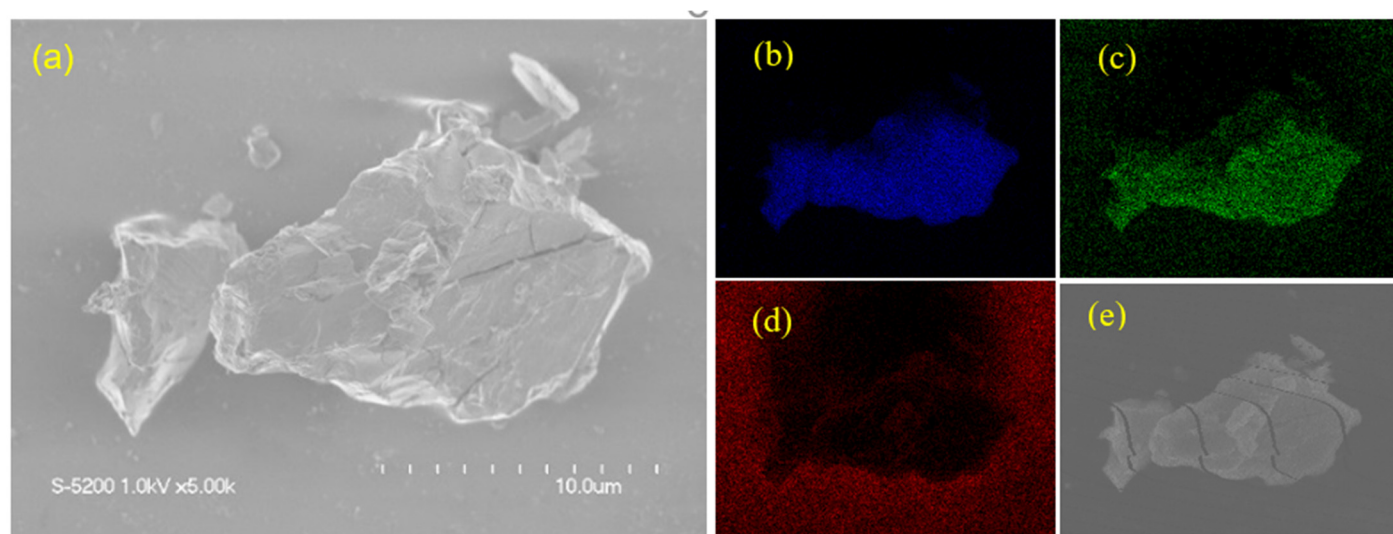


Figure S1. SEM measurement (a) α -K₆P₂W₁₈O₆₂·14H₂O (b) Tungsten element (c) Oxygen element (d) Carbon K- α X-ray element (e) Secondary electron image.

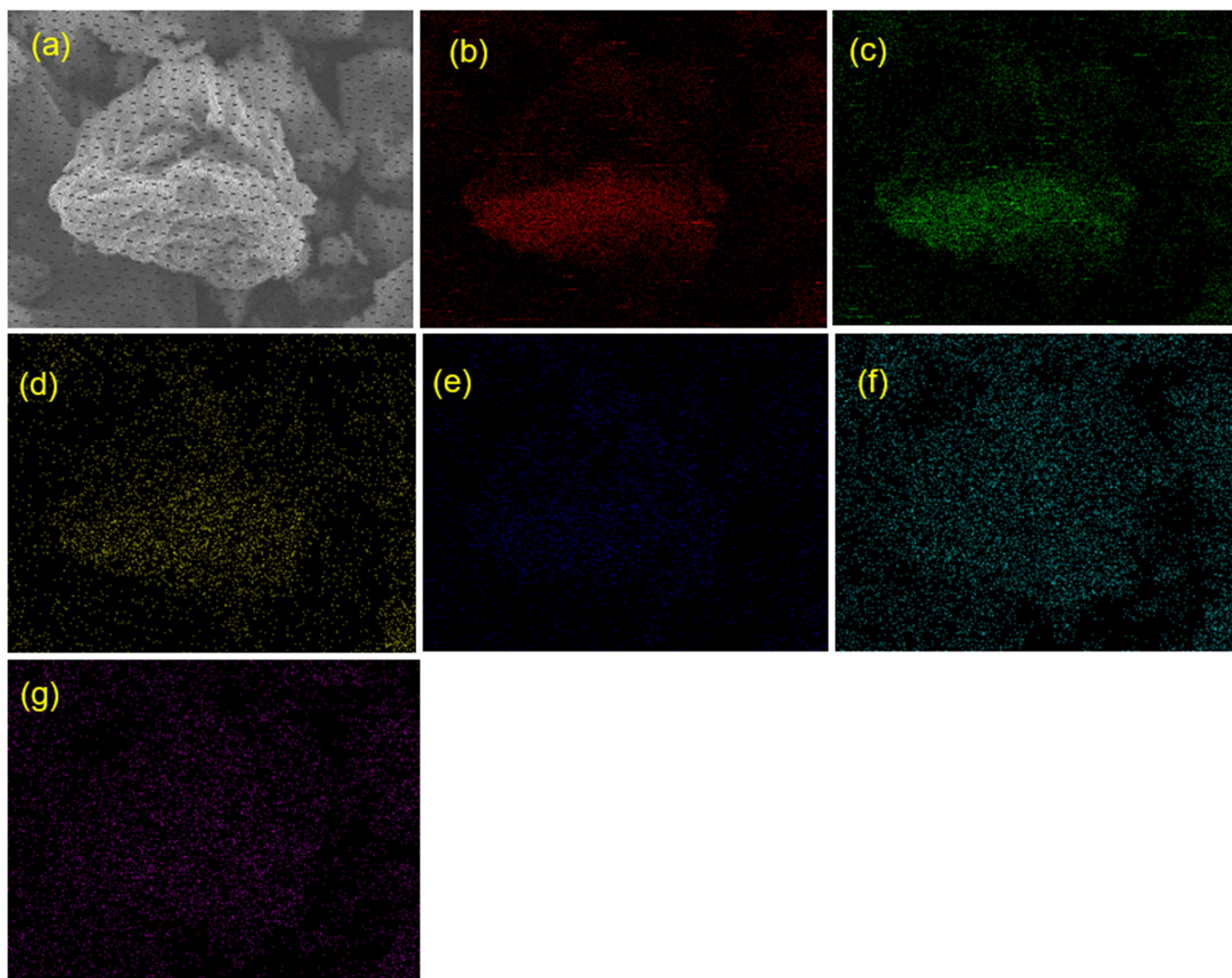


Figure S2. SEM measurement, $[GO_{70}POM]_{41}$ (a) Secondary electron image (b) Carbon K- α X-ray element (c) Oxygen element (d) Tungsten element (e) Aluminum element (f) Cesium element (g) Chloride element.

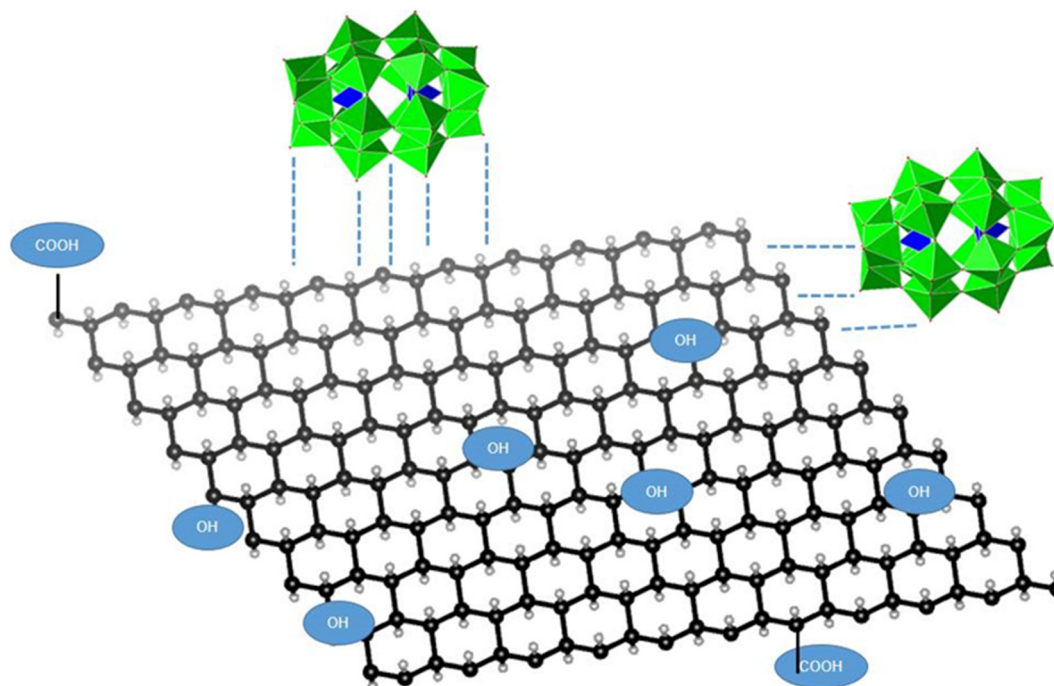


Figure S3. Plausible Interaction between Graphene-Oxide (GO) and Dawson-type Polyoxometalates (POMs). The black and the grey balls corresponds to carbon and hydrogen. The polyhedral model represents to Dawson-type polyoxometalates. The blue dashes indicated of the presence of interaction between GO-POMs.

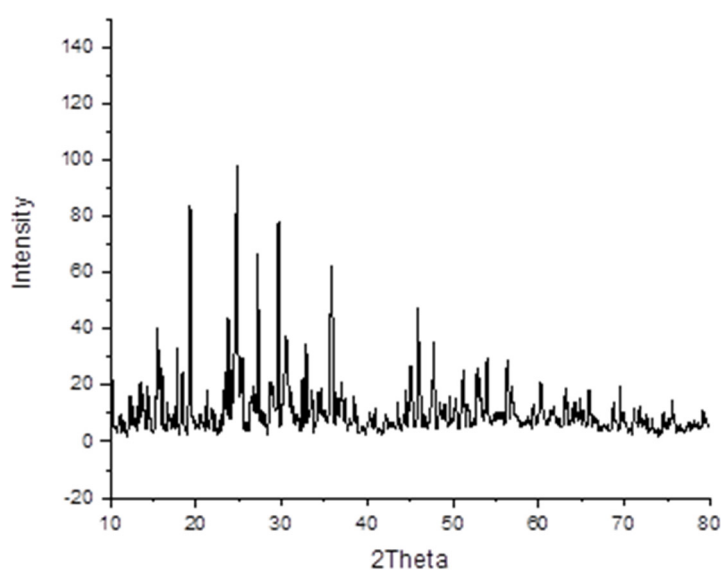


Figure S4. Xrd pattern of $\alpha\text{-K}_6\text{P}_2\text{W}_{18}\text{O}_{62}\cdot 14\text{H}_2\text{O}$.

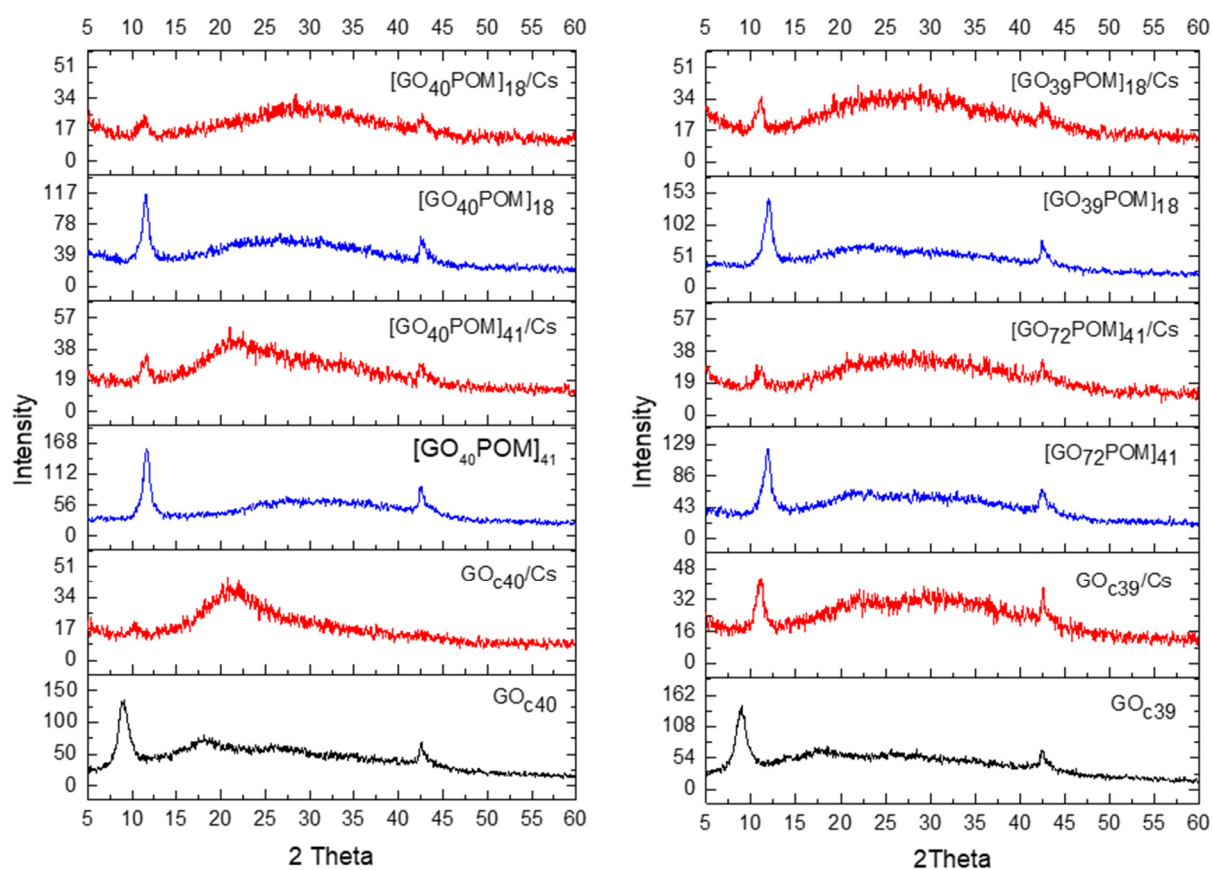


Figure S5. XRD pattern of GO_{c39}, GO_{c40}, GOPOM composite before and after Cs adsorption.

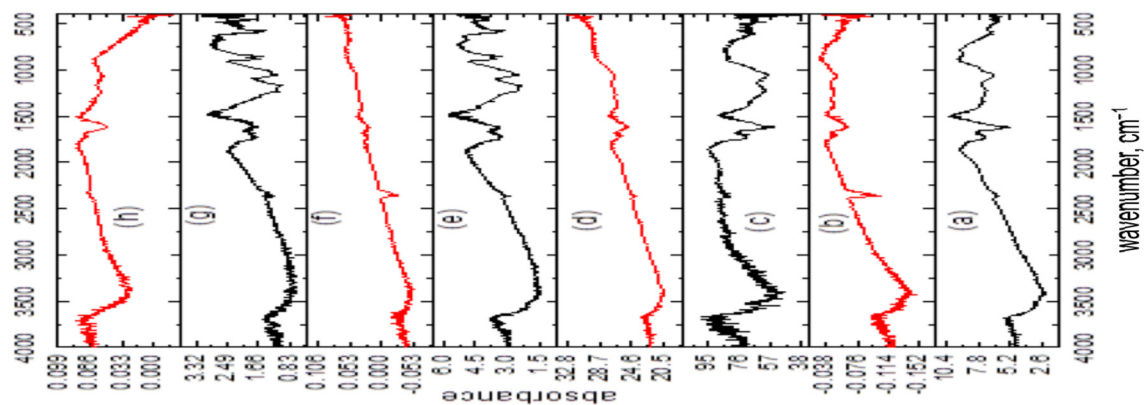


Figure S6. IR spectra for (a) GO_{70} (b) GO_{72} after Cs adsorption (c) GO_{72} (d) GO_{72} after Cs adsorption (e) GO_{39} (f) GO_{39} after Cs adsorption (g) GO_{40} (h) GO_{40} after Cs adsorption.

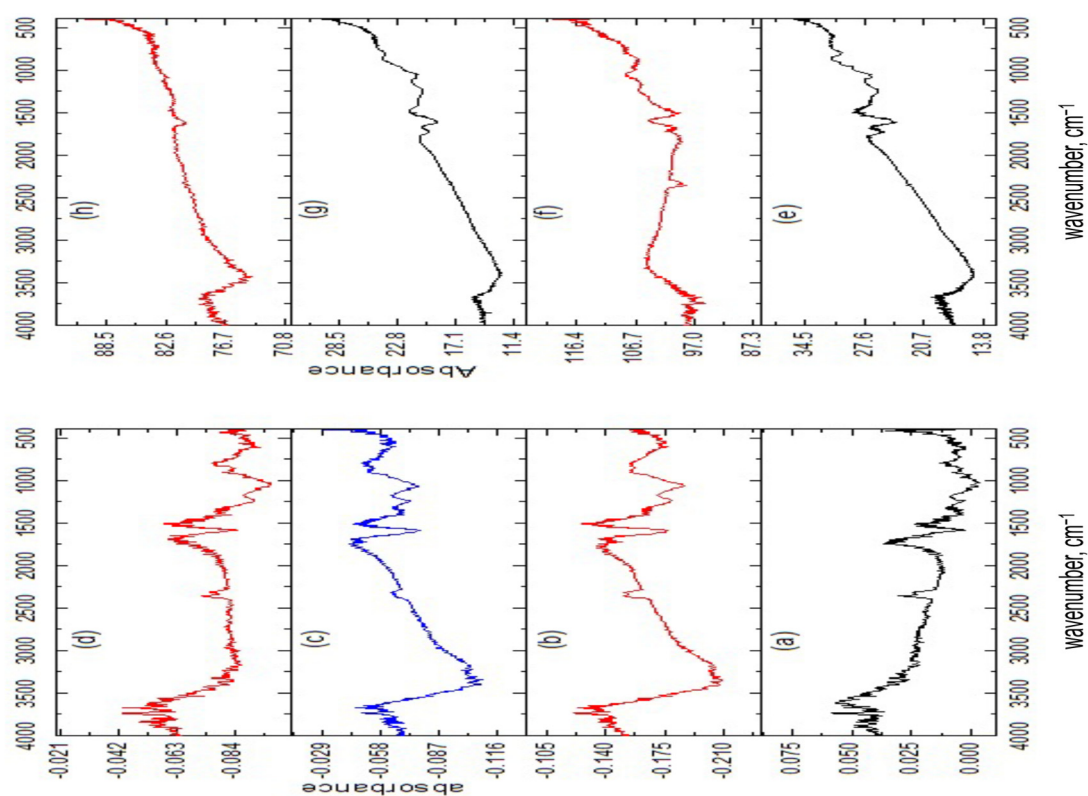


Figure S7. IR spectra for (a) $[\text{GO}_{39}\text{POM}]_{18}$ (b) $[\text{GO}_{39}\text{POM}]_{18}$ after Cs adsorption (c) $[\text{GO}_{39}\text{POM}]_{41}$ (d) $[\text{GO}_{39}\text{POM}]_{41}$ after Cs adsorption (e) $[\text{GO}_{40}\text{POM}]_{18}$ (f) $[\text{GO}_{40}\text{POM}]_{18}$ after Cs adsorption (g) $[\text{GO}_{40}\text{POM}]_{41}$ (h) $[\text{GO}_{40}\text{POM}]_{41}$ after Cs adsorption.

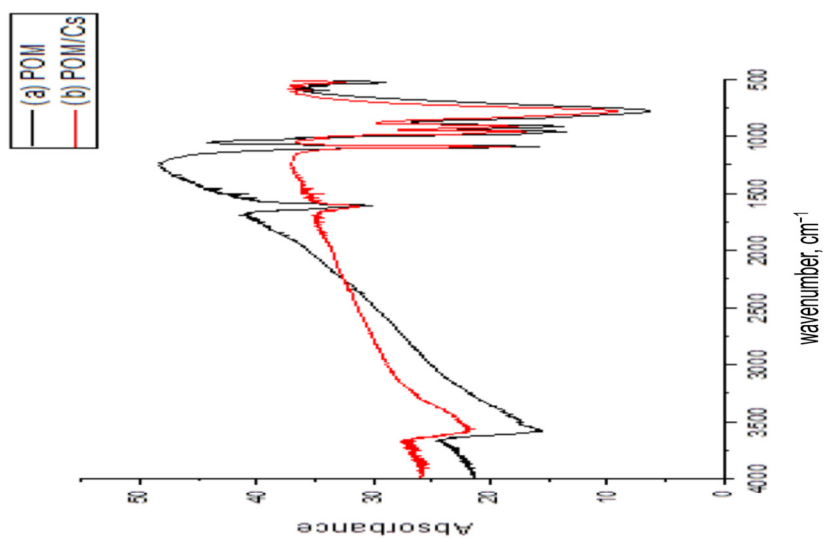


Figure S8. IR spectra for (a) POM (b) POM after Cs adsorption.

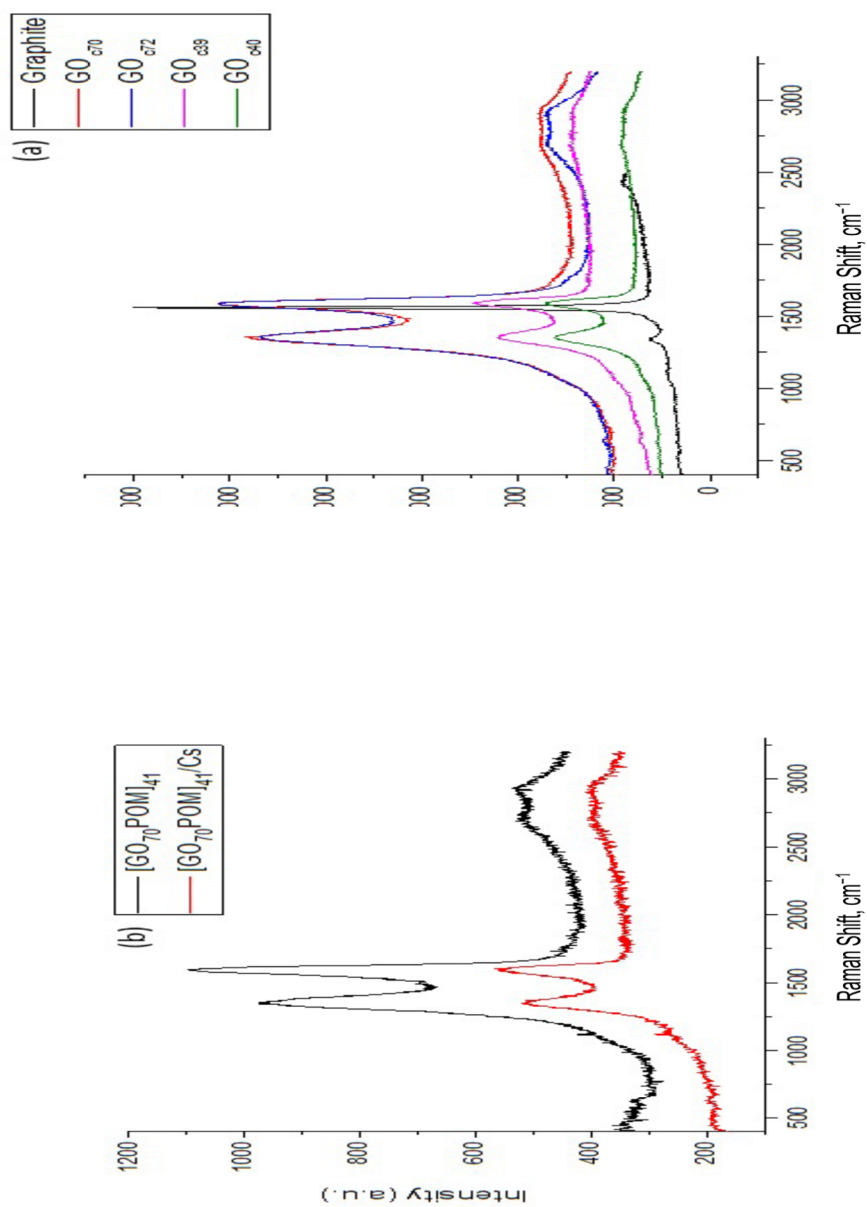


Figure S9. Raman spectra (a) Graphite, GO_{c70}, GO_{c72}, GO_{c39}, GO_{c40}, (b) [GO₇₀POM]₄₁ and after Cs adsorption.

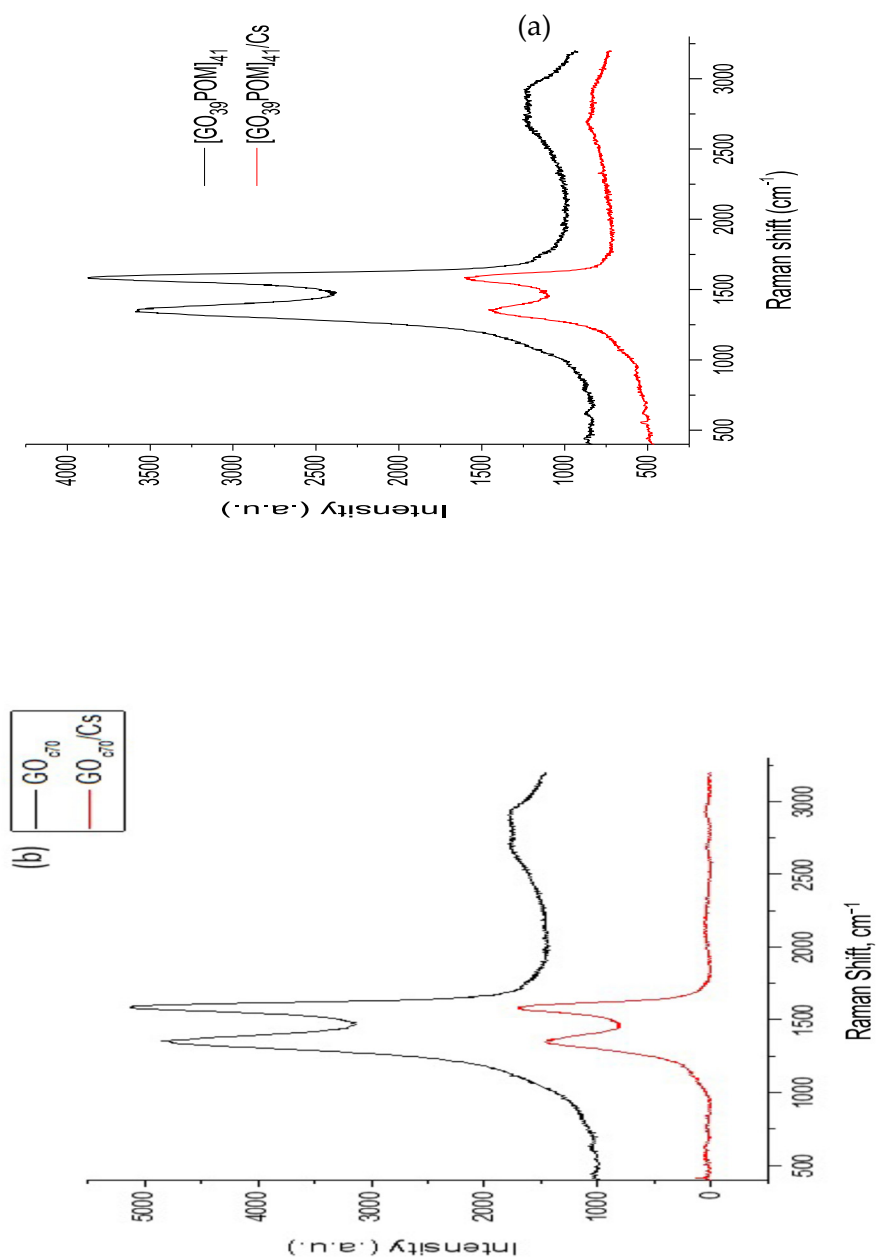


Figure S10. Raman spectra composite (a) $[GO_{39}POM]_{41}$ before and after Cs adsorption (b) GO_{c70} before and after Cs adsorption.

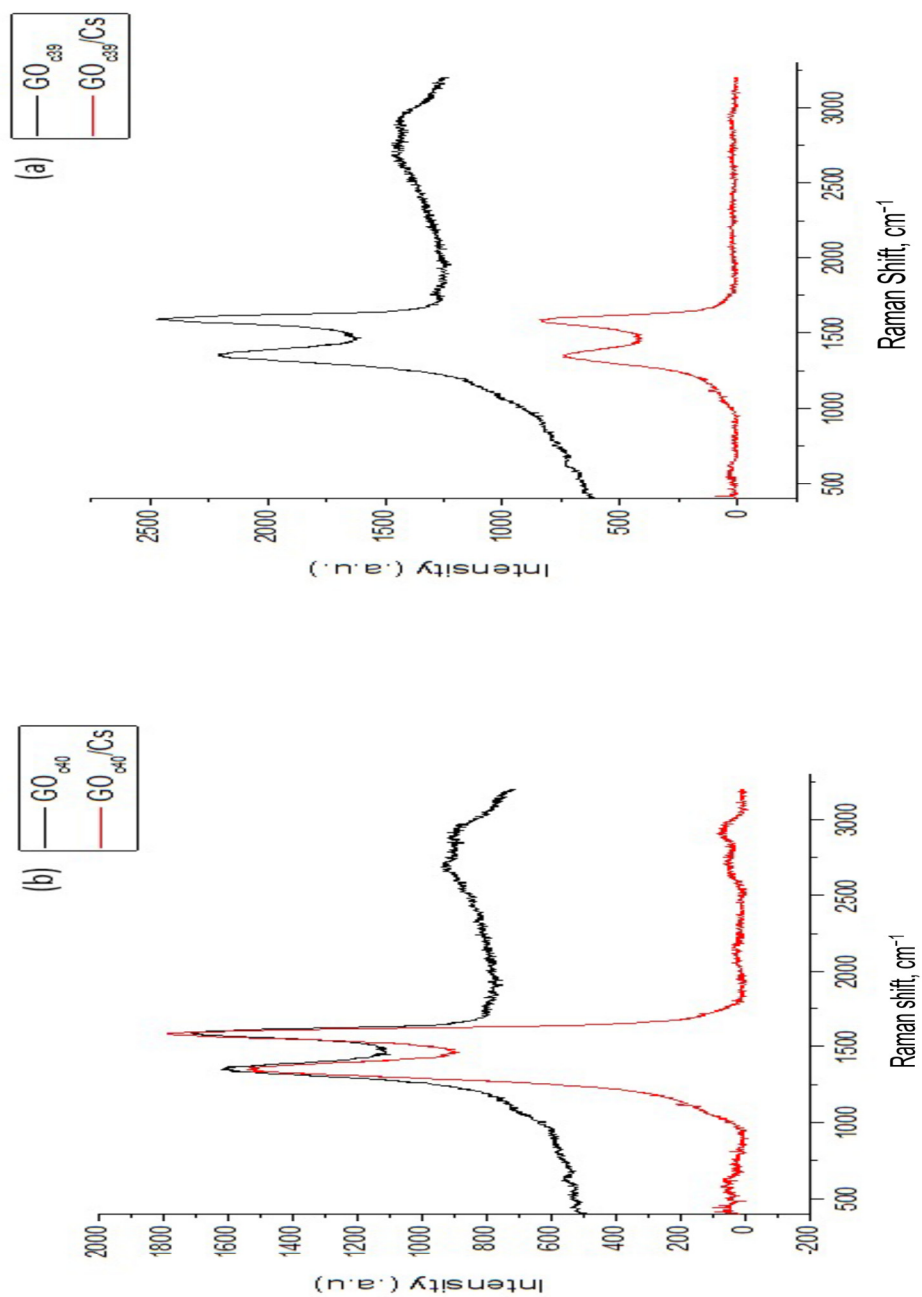


Figure S11. Raman spectra (a) GO_{c39} before and after Cs adsorption (b) GO_{c40} before and after Cs adsorption.

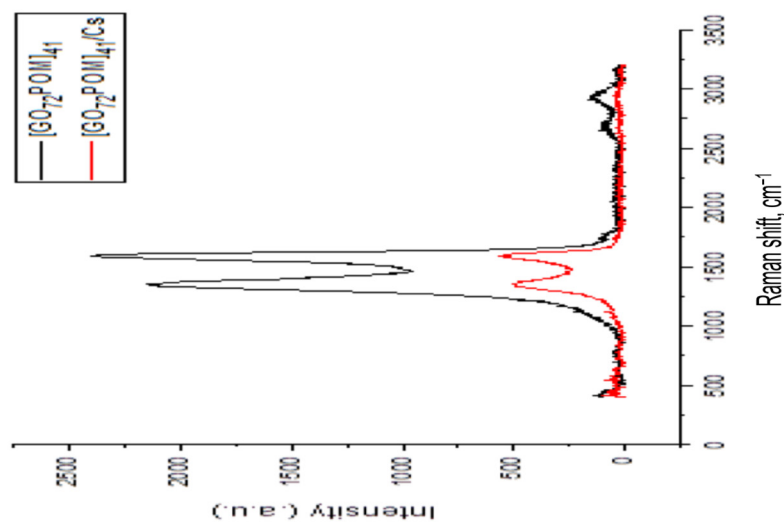


Figure S12. Raman spectra composite [GO₇₂POM]₄₁ before and after Cs adsorption.



Figure S13. The composite solution after Cs adsorption. Only Composite [GO₇₀POM]₄₁ (b) that forms stable solution (black color). Another composite solution shows remains coagulated. The photo was taken after more than one-hour stay at ambient temperature.



Figure S14. The GO solution after Cs adsorption. All GO solutions shows remains coagulated. (a) GO_{c70} and (b) GO_{c72} shows different coagulated behavior with (c) GO_{c39} and (d) GO_{c40}. The photo was taken after more than one-hour stay at ambient temperature.

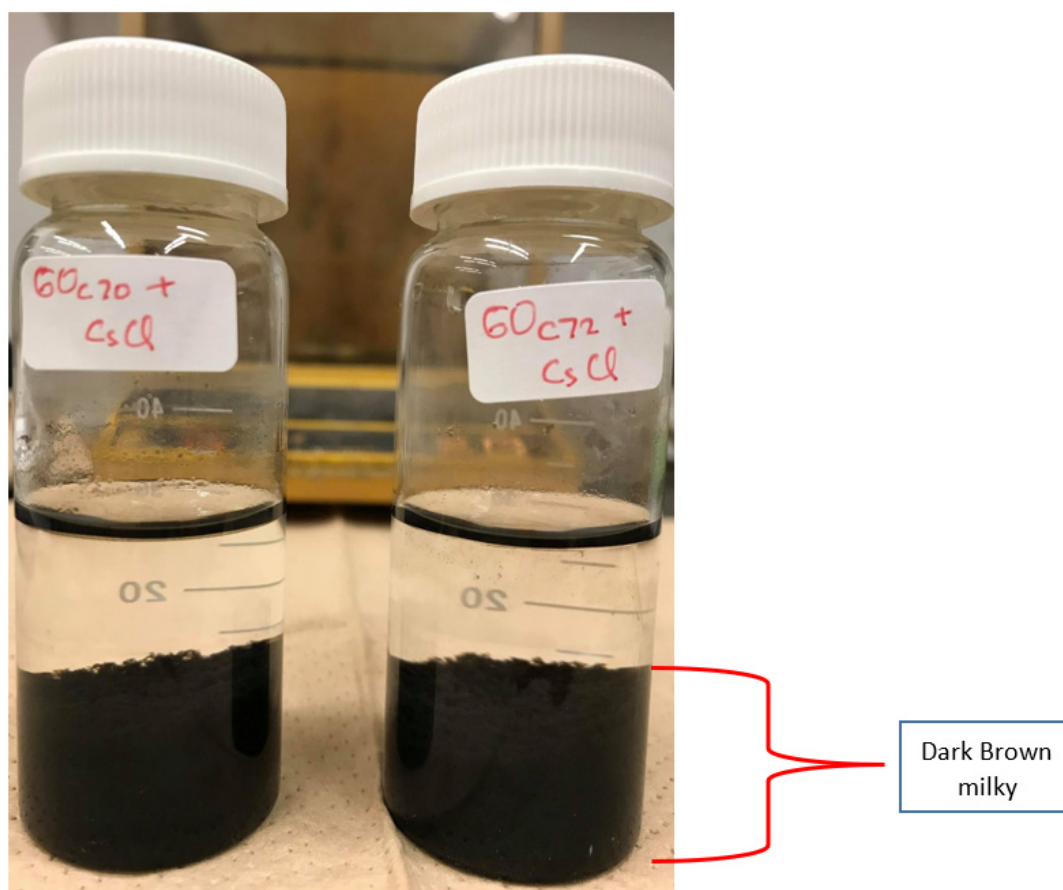


Figure S15. Coagulation process after Cs interaction with (a) GO_{c70} and (b) GO_{c72}. The photo was taken after more than one-hour stay at ambient temperature.

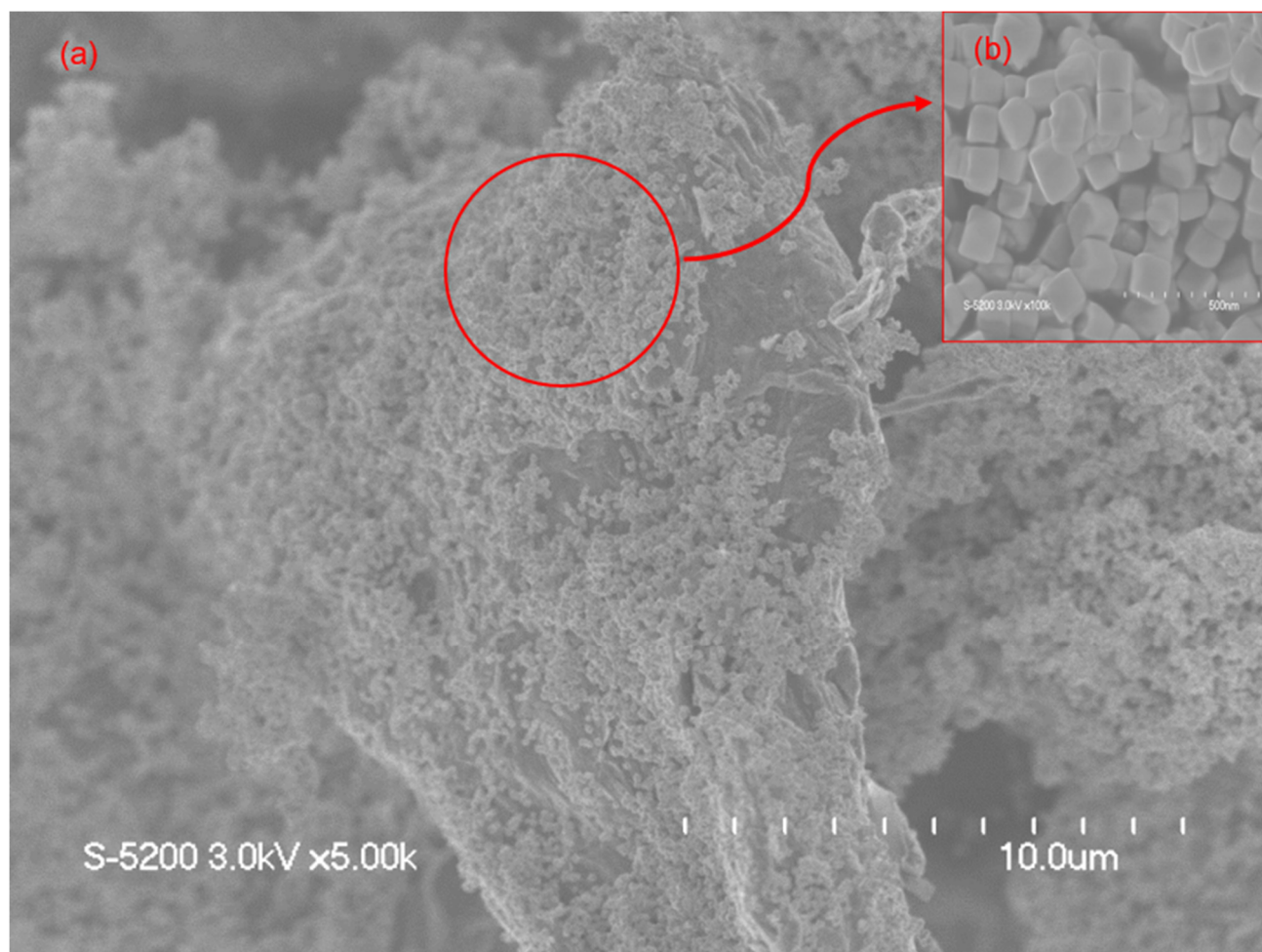


Figure S16. SEM image by using composite (a) $[GO_{70}POM]_{41}$ after Cs adsorption and (b) Cs particle (zoom mode based on figure a).

Table S1. The ratio I_D/I_G of Graphene oxide and composite before and after Cs adsorption.

No.	Material	D band	G band	Ratio I_D/I_G
1	GO_{c70}	1356	1586	0.93
2	GO_{c72}	1352	1581	0.91
3	GO_{c39}	1352	1590	0.89
4	GO_{c40}	1347	1590	0.88
5	$[GO_{39}POM]_{41}$	1347	1581	0.92
6	$[GO_{39}POM]_{41}/Cs$	1352	1586	0.90
7	$[GO_{70}POM]_{18}$	1347	1586	0.96
8	$[GO_{70}POM]_{18}/Cs$	1352	1577	0.92
9	$[GO_{70}POM]_{41}$	1357	1592	0.88
10	$[GO_{70}POM]_{41}/Cs$	1343	1602	0.93

Table S2. The crystallize size of GO.

Sample	Concentration ratio GO:POM	2 Φ (°)	FWHM (β)	Out of plane crystallite size d (nm) – D (nm)		D (nm) after Cs adsorption	Layer (n)	In plane crystallite size – L (nm)
Graphite	-	26.6	0.28	30.49	0.34	-	90.67	10.27
GO _{c70}	-	11.58	1.93	4.3	0.77	-	6.58	2.59
GO _{c72}	-	8.66	1.69	4.9	1.02	-	5.80	2.53
GO _{c39}	-	8.91	1.57	5.3	0.99	-	6.19	2.56
GO _{c40}	-	9.13	1.47	5.7	0.97	-	6.75	2.61
[GO ₇₀ POM] ₁₈	1:8	12.28	1.63	5.12	0.72	0.79	-	2.54
[GO ₇₀ POM] ₄₁	4:1	10.99	1.48	5.64	0.81	0.86	-	2.61
[GO ₇₂ POM] ₁₈	1:8	12.75	1.10	7.60	0.69	0.77	-	3.04
[GO ₇₂ POM] ₄₁	4:1	12.05	1.07	7.80	0.73	0.79	-	3.09
[GO ₃₉ POM] ₁₈	1:8	11.92	1.19	7.02	0.74	0.81	-	2.89
[GO ₃₉ POM] ₄₁	4:1	11.86	1.07	7.80	0.74	0.79	-	3.09
[GO ₄₀ POM] ₁₈	1:8	11.57	0.84	9.94	0.76	0.83	-	3.71
[GO ₄₀ POM] ₄₁	4:1	11.57	0.24	34.78	0.76	0.78	-	11.95

*FWHM was calculated by using origin software.