

Dendritic polyamide-amine modified phosphomolybdovanadic hybrid microsphere as catalyst for methacrolein to methacrylic acid

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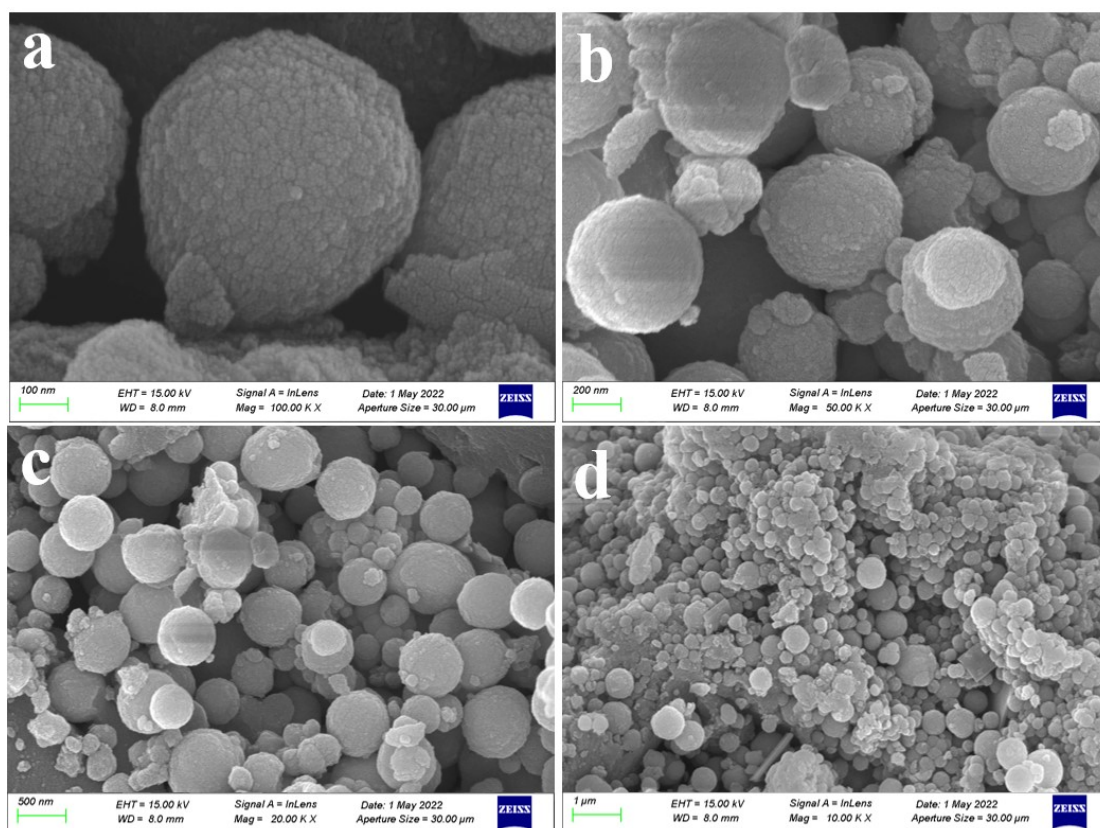


Fig. S1. SEM images of 100 nm, calcined PAMAM-CsPAV (a), 200 nm, calcined PAMAM-CsPAV (b), 500 nm, calcined PAMAM-CsPAV (c) and 1 μm, calcined PAMAM-CsPAV (d).

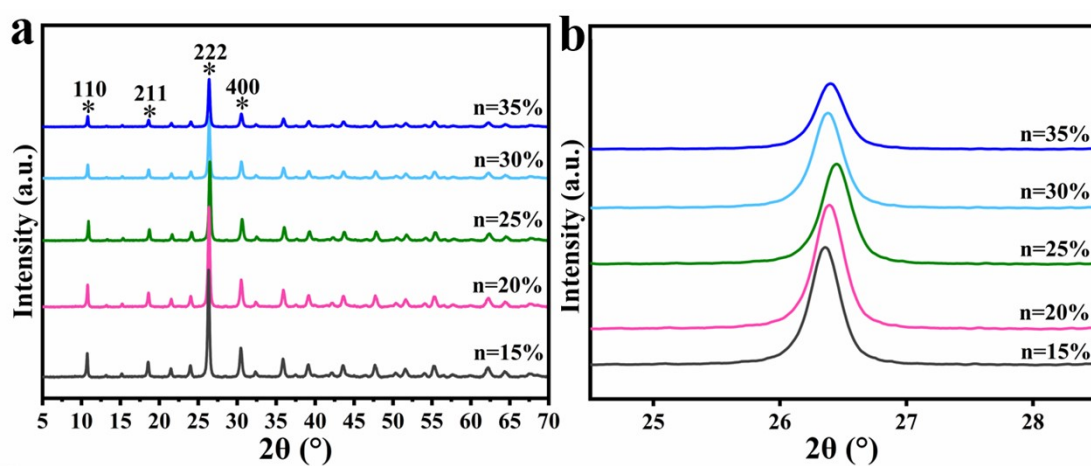


Fig. S2. The XRD and local patterns of calcined PAMAM_n-CsPAV (n = 15-35%).

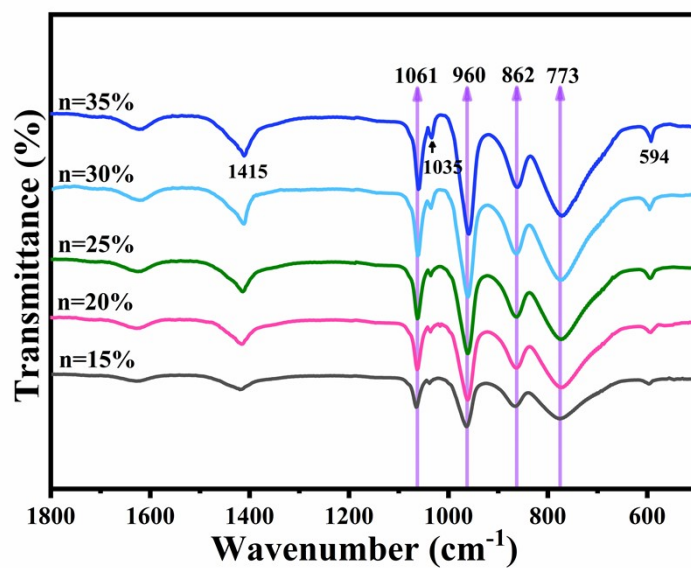


Fig. S3. FT-IR spectra of calcined PAMAM_n-CsPAV (n = 15-35%).

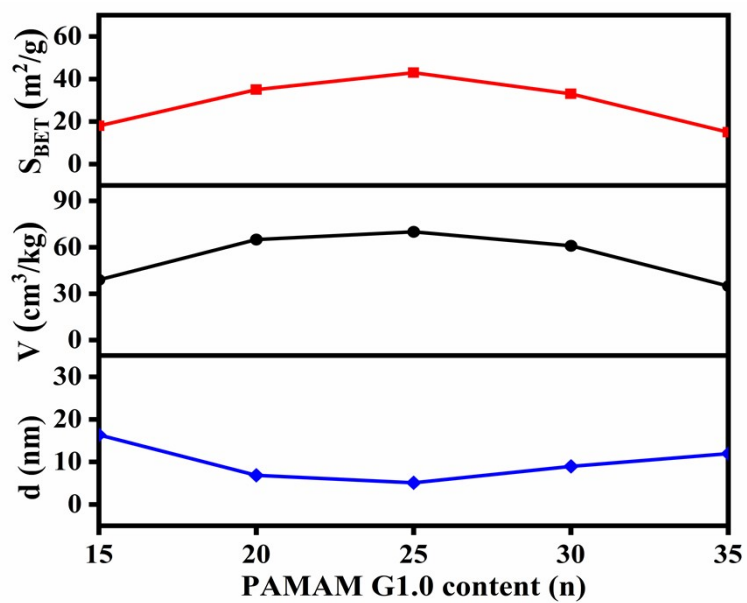


Fig. S4. Specific surface area, pore volume and pore diameter of calcined PAMAM_n-CsPAV (n = 15-35%).

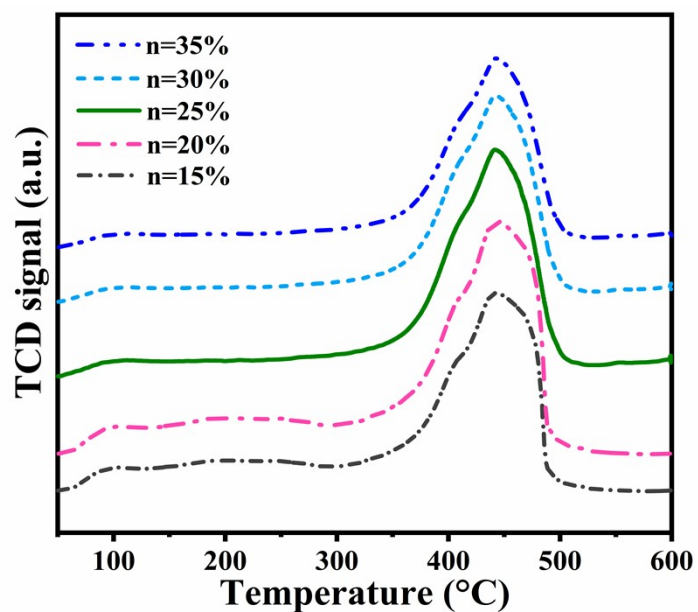


Fig. S5. The NH₃-TPD curves of calcined PAMAM_n-CsPAV (n = 15-35%).

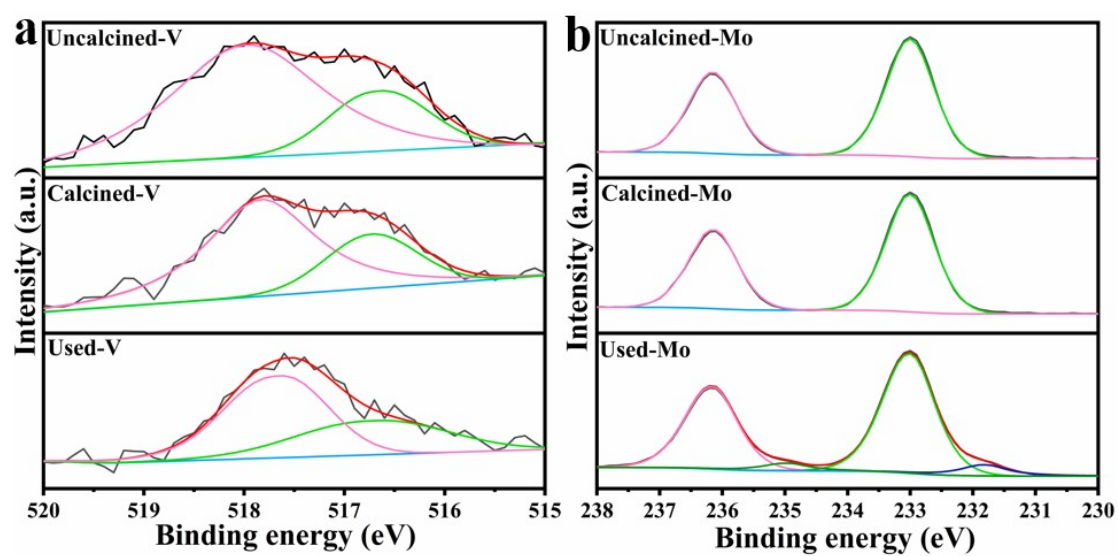


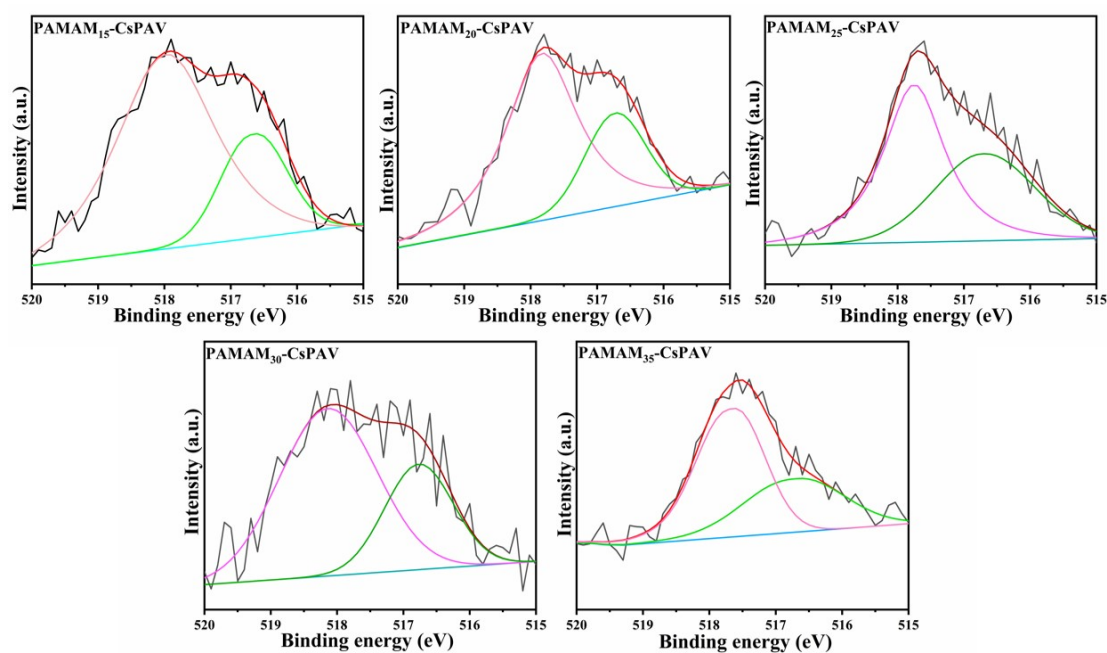
Fig. S6. (a) V 2p_{3/2} and (b) Mo 3d XPS spectra of the uncalcined, calcined and used CsPAV.

Table S1. Surface analysis results for the CsPAV and PAMAM-CsPAV.

Samples		V 2p _{3/2} V ⁴⁺ /V ⁵⁺	Mo 3d Mo ⁵⁺ /Mo ⁶⁺	N 1s/Mo 3p _{3/2} NH ₄ ⁺ /Mo ⁶⁺
CsPAV	Uncalcined	516.62/571.87	-/233.05, -/236.15	-/398.91
	Calcined	516.73/517.83	-/233.05, -/236.15	-/398.92
	used	516.66/517.62	231.89/233.05, 235.06/236.16	-/398.84
CsPAV-PAMAM	Uncalcined	516.68/517.75	-/233.28, -/236.43	402.31/398.90
	Calcined	516.77/518.14	-/233.28, -/236.43	402.34/398.85
	used	516.78/517.94	231.99/233.28, 235.14/236.43	402.32/398.89

Table S2. Surface analysis results for the CsPAV and PAMAM-CsPAV.

Samples		Atomic ratio	Molar ratio		
		P/Mo/N/V	V ⁴⁺ /V ⁵⁺	NH ₄ ⁺ /Mo ⁶⁺	Mo ⁵⁺ /Mo ⁶⁺
CsPAV	Uncalcined	2.42/13.65/-/0.89	0.31	-	-
	Calcined	2.34/13.89/-/0.63	0.40	-	-
	used	2.65/14.36/-/0.55	0.60	-	0.11
CsPAV-PAMMA	Uncalcined	2.57/9.76/0.76/0.37	0.44	0.038	-
	Calcined	2.69/9.94/0.53/0.45	0.76	0.065	-
	used	2.61/9.35/0.41/0.43	1.96	0.030	0.08

**Fig. S7.** V 2p_{3/2} XPS spectra of the calcined PAMAM_n-CsPAV (n = 15-35%).

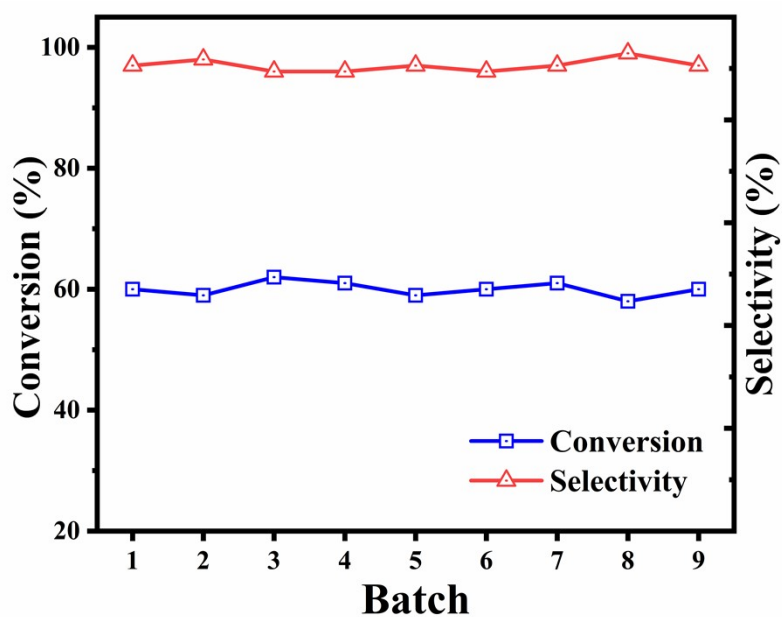


Fig. S8. Effect of different preparation batches on catalytic performance of calcined

Table S3. Evaluation results of catalytic performance of PAMAM_n-CsPAV.

n (%)	MAL Conversion (%)	Selectivity to MAA (%)	Yield of MAA (%)
15	56.3	79.7	44.9
20	57.1	90.0	52.3
25	60.4	97.2	58.7
30	58.6	88.5	51.9
35	56.9	72.4	41.2

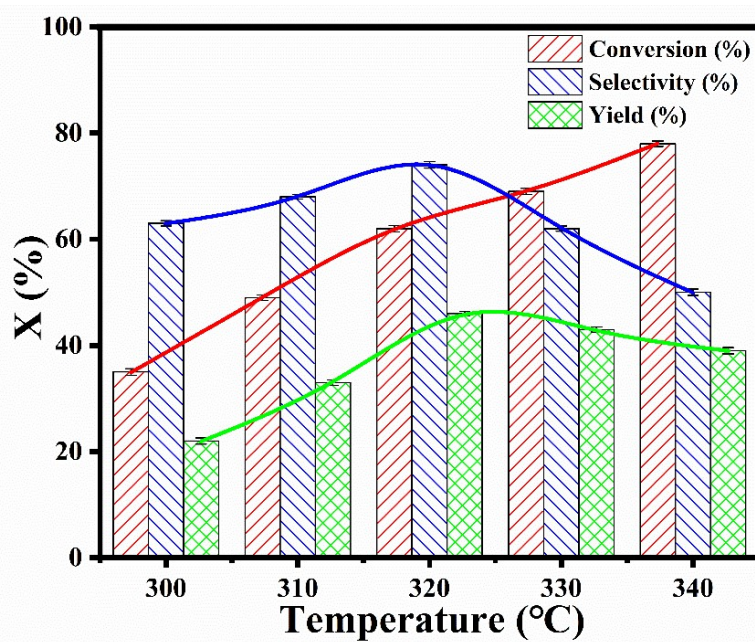


Fig. S9. Effects of reaction temperature on the performance of the calcined CsPAV.

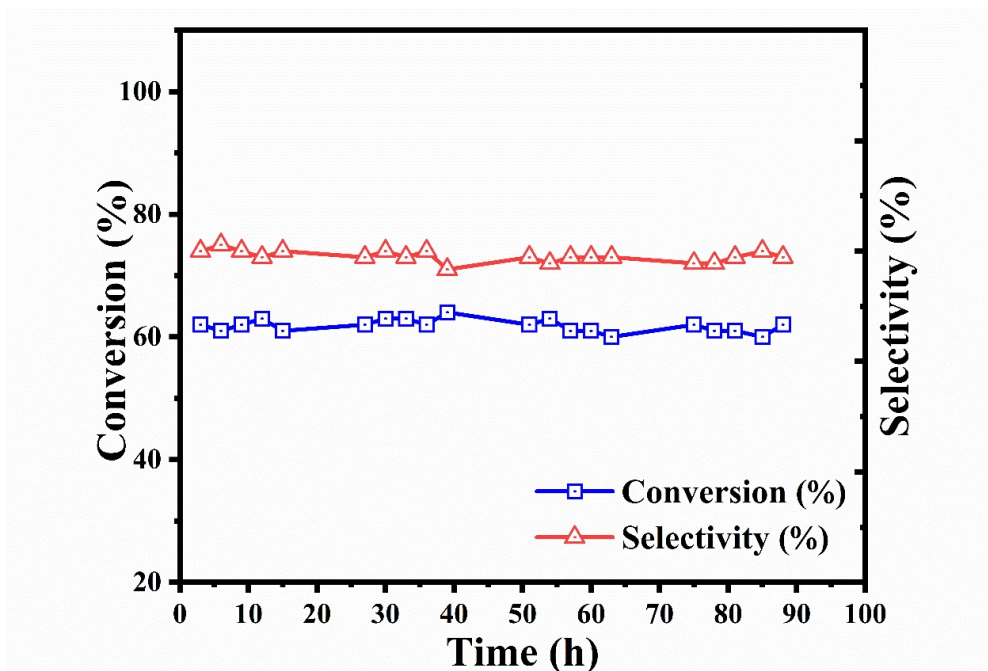


Fig. S10. The long-term performance of the calcined CsPAV (88 h).