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Auteurs: Authors:	Tien Dat Nguyen, Nooshin Saadatkhah, Yanfa Zhuang, Jacopo De Tommaso, Karen Stoeffler, Adrien Faye, & Gregory Scott Patience
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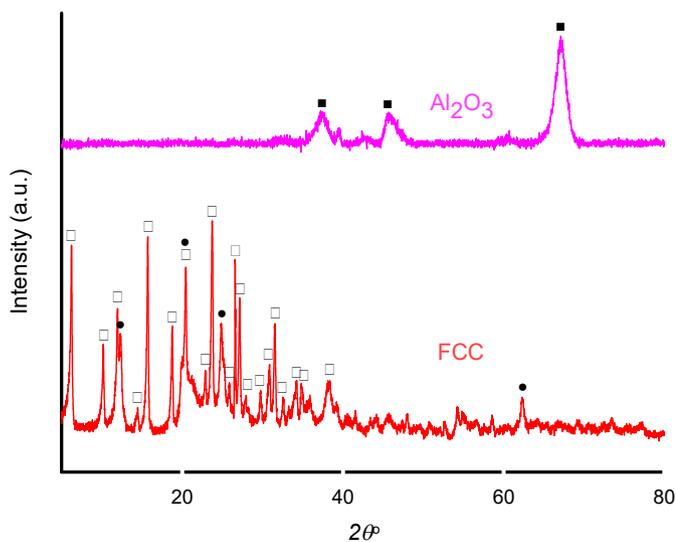
FIGURE A1 X-ray powder diffraction over fresh γ-Al$_2$O$_3$ and FCC: squares - γ-Al$_2$O$_3$; triangles - Zeolite Y; circles - Kaolinite; rhombus - SiO$_2$.
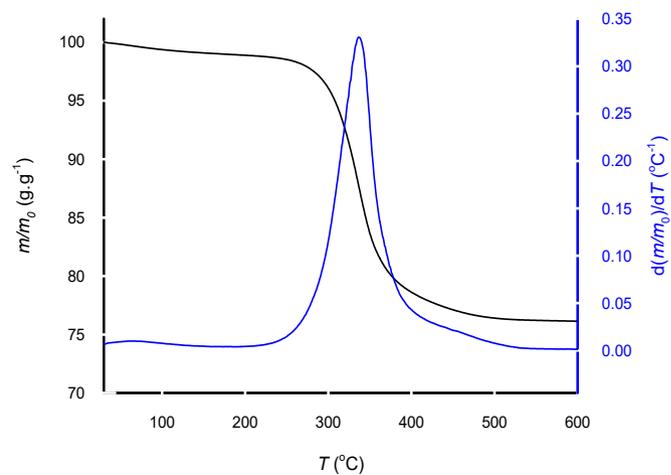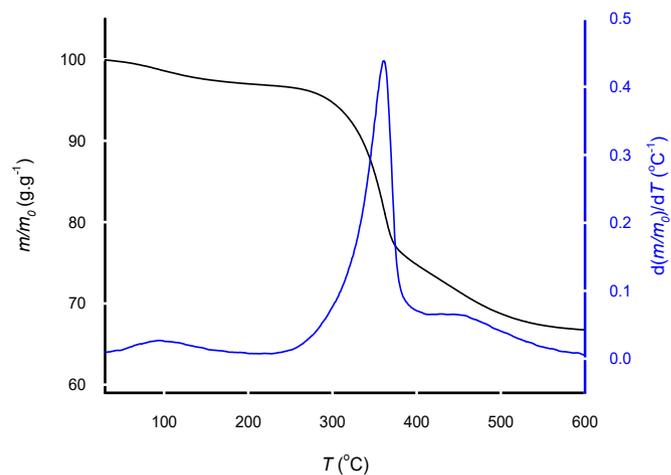

FIGURE A2 TGA (black curve) and DTG (blue curve) analysis of Al$_2$O$_3$ bed residue in air (60 mL/min).

APPENDIX

A SUPPLEMENTARY INFORMATION

**FIGURE A3** TGA (black curve) and DTG (blue curve) analysis of FCC bed residue in air (60 mL/min).

TABLE A1 PMMA depolymerization carbon balance.

| Catalyst	T °C	U_g mm s^{-1}	m g	X_{PMMA} * %	Y_{MMA} %	Y_{acet} %	S_{MMA} %	S_{acet} %	C_{resid}** % mass	CO % mass	CH$_4$ % mass	CO$_2$ % mass	C_{recov} % mass
Al$_2$O$_3$	380	38	10	42.60	13.90	0.29	32.62	0.68	58.95	1.42	2.48	1.93	78.97
FCC	380	38	10	94.52	1.65	1.16	1.75	1.22	59.35	6.82	1.28	4.82	75.07
FCC	350	38	7	63.99	1.50	1.38	2.34	2.15	69.46	5.55	0.73	2.41	81.03
FCC	350	50	7	74.62	1.20	0.59	1.61	0.79	72.06	3.30	0.74	4.01	81.91
Al$_2$O$_3$	380	50	7	65.03	46.00	0.24	70.73	0.38	43.87	0.08	0.85	11.40	102.45
Al$_2$O$_3$	350	50	10	23.33	3.86	0.39	16.54	1.69	83.51	2.17	2.12	1.31	93.36
FCC	380	38	7	87.66	2.78	1.32	3.17	1.51	57.37	8.34	1.36	5.50	76.67
Al$_2$O$_3$	350	38	10	32.97	4.79	0.52	14.53	1.56	64.58	1.62	1.73	1.57	74.80
FCC	380	50	10	84.65	1.35	0.67	1.60	0.79	61.28	4.52	1.43	9.78	79.02
Al$_2$O$_3$	350	38	7	21.89	19.72	2.61	90.07	11.93	69.41	2.43	1.36	1.11	96.64
Al$_2$O$_3$	350	50	7	42.82	26.45	0.99	61.77	2.30	66.12	1.64	1.22	6.49	102.92
FCC	350	50	10	73.95	1.14	4.05	1.54	5.48	71.58	6.51	0.86	2.97	87.10

* TGA, **LECO
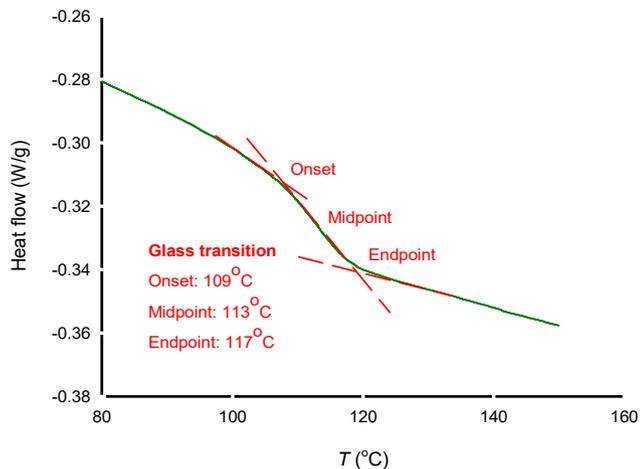
FIGURE A4 DSC analysis of pure PMMA gives onset T_g = 109 °C; midpoint = 113 °C; endpoint = 117 °C.
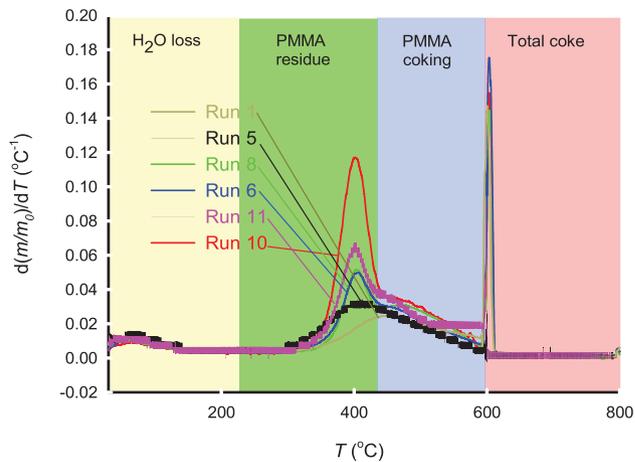

FIGURE A5 DTG profile from the decomposition of solid residue for γ-Al$_2$O$_3$ bed.

TABLE A2 Average molecular weight and free volume change with each recycling cycle.
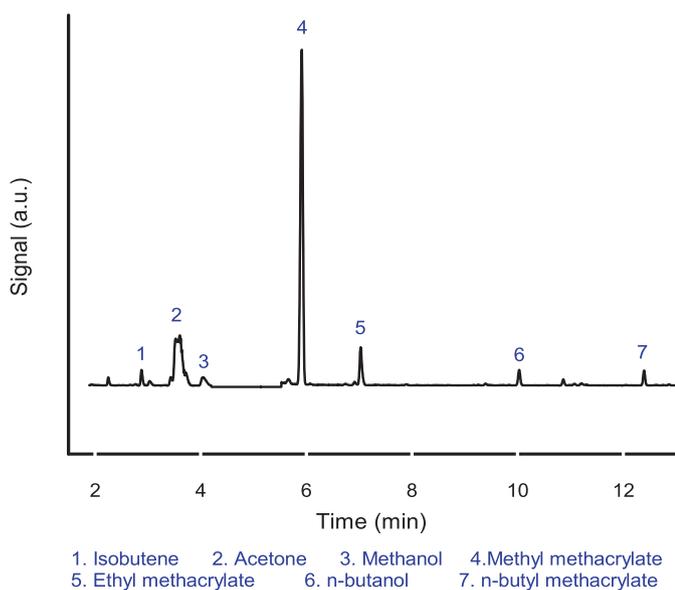
Cycle	M_w g mol^{-1}	M_n g mol^{-1}	DP	v_f mL g^{-1}	v mL g^{-1}
0	120100	77300	773	2.43×10^{-3}	960×10^{-3}
1	115400	76300	763	8.71×10^{-3}	915×10^{-3}
3	112000	73400	734	14.11×10^{-3}	892×10^{-3}
5	110600	70900	709	36.62×10^{-3}	896×10^{-3}
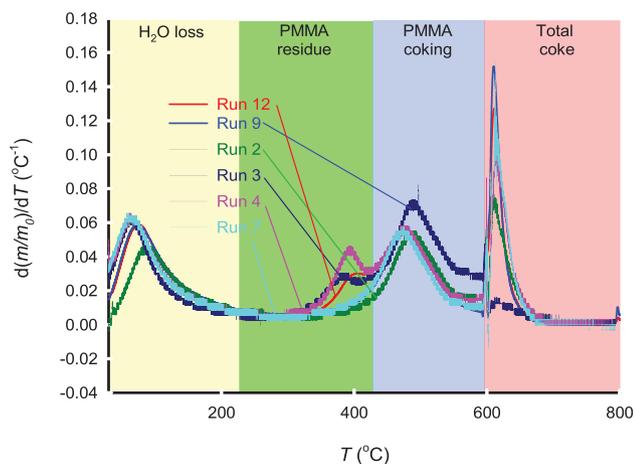
FIGURE A6 DTG profile from the decomposition of solid residue for FCC bed.
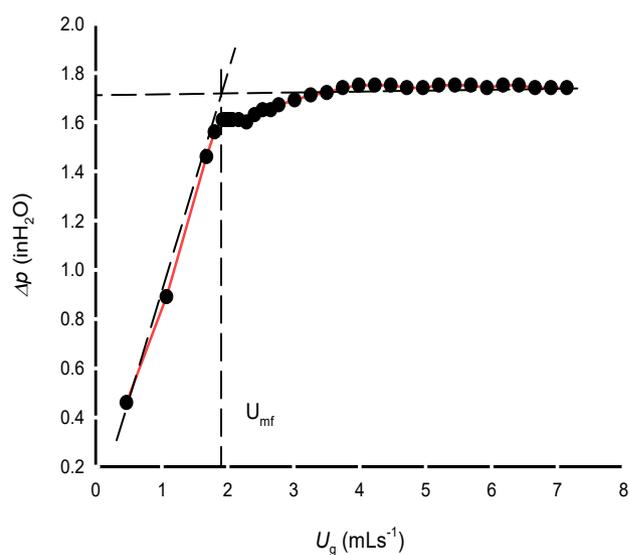
FIGURE A8 Determining U_{mf} of SiC bed by pressure drop method: the pressure drop between the inlet and outlet of the reactor is measured with different carrier gas velocities. [32] U_{mf} is determined by the junction between the linear regression line from the pack-bed region (the rising part) and the bubbling fluidization region (the region with constant Δp). [33]

1. Isobutene   2. Acetone   3. Methanol   4. Methyl methacrylate
5. Ethyl methacrylate   6. n-butanol   7. n-butyl methacrylate

FIGURE A7 GC-MS chromatogram of liquid fraction in full scan mode.