Supplementary Information—Structural studies of thermally stable, combustion resistant polymer composites

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1. Temperature-Modulated Differential Scanning Calorimetry (TMDSC)

The glass transition temperature T_g has been measured using TMDSC, and the maxima of the peaks are taken as the value of the T_g. Figure 1 shows the derivative of reversible heat flow as a function of temperature. The T_g values are essentially the same for the four samples.

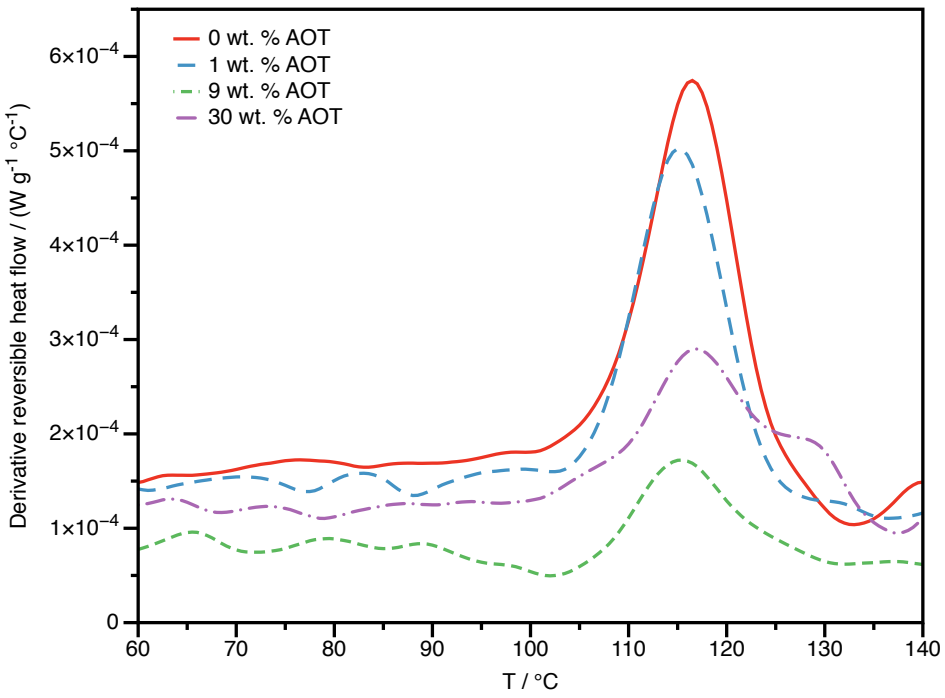

Figure 1: TMDSC data of PMMA-AOT composites. The T_g is defined as the peak in a plot of the derivative of reversible heat flow [1]. Regardless of the amount of AOT incorporated, the T_g is found to be $\sim$ 116°C, consistent with values measured for commercial PMMA [1]. This shows that incorporating AOT into the composite materials does not significantly modify their thermal properties, aside from degradation.

2. Thermogravimetric Analysis (TGA)

The degradation of PMMA-AOT composites was monitored using TGA. The degradation of PMMA homopolymer has been compared to literature (Ferriol *et al.* [2]). The most similar sample from Ferriol *et al.* was chosen ($M_w = 9.96 \times 10^5$ g mol^{-1}, $\phi = 10$°C min^{-1}). The temperature derivative of the PMMA degradation (dα/dT) has been fit as a summation of several steps (four for Ferriol's data and five for the data in this study). The modeled curves are shown in Figure 2. The smearing of the degradation steps in this study is due to broad molar mass distribution ($Đ_m$) as discussed in the text.

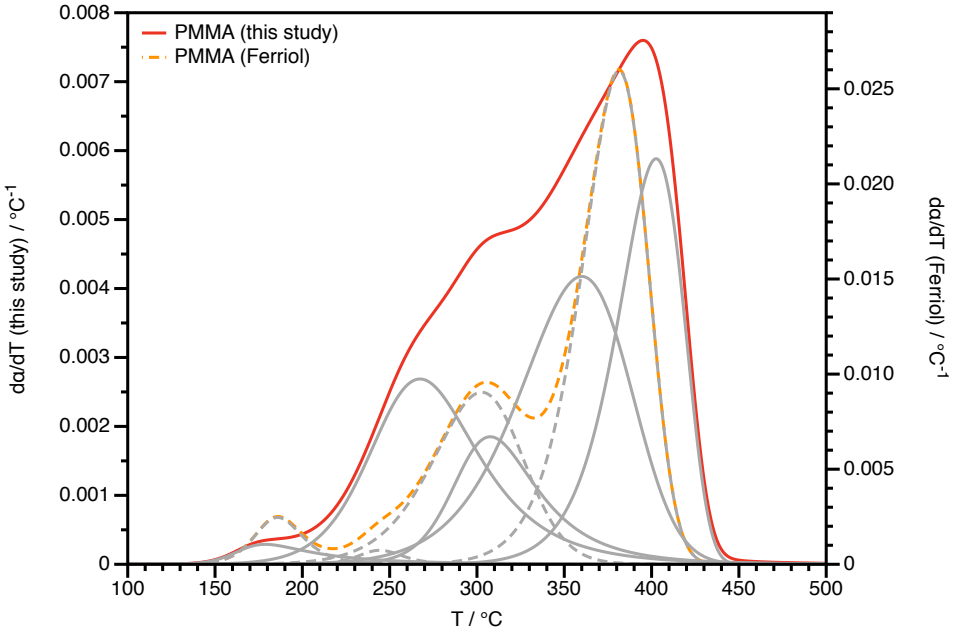

Figure 2: Temperature derivative of TGA data (dα/dT) of PMMA degradation modeled as a series of independent steps. Data from this study is compared to the literature data of Ferriol *et al.* [2].

The parameters used to model the thermal degradation of 0 and 1 wt. % AOT PMMA-AOT composites are shown in Table 1.

Table 1: TGA fitting parameters.

0 wt. % AOT	A_i / min^{-1}	E_i / (kJ mol^{-1})	n_i	r_i
Peak 1	9.92×10^{20}	179.4	4.94	0.020
Peak 2	3.05×10^{11}	119.3	2.37	0.228
Peak 3	2.08×10^{18}	202.3	2.89	0.124
Peak 4	5.25×10^{8}	108.0	1.12	0.339
Peak 5	2.37×10^{15}	198.6	1.00	0.290

1 wt. % AOT	A_i / min^{-1}	E_i / (kJ mol^{-1})	n_i	r_i
Peak 1	2.74×10^{21}	182.7	1.37	0.001
Peak 2	1.60×10^{8}	85.9	1.59	0.210
Peak 3	8.22×10^{12}	144.2	1.19	0.133
Peak 4	1.47×10^{9}	115.7	1.57	0.360
Peak 5	2.00×10^{15}	205.1	1.00	0.290

3. Pyrolysis Combustion Flow Calorimetry (PCFC)

The parameters for the individual PCFC measurements are shown in Table 2, along with the correlation coefficient (CC).

Table 2: Values of some relevant parameters from individual PCFC runs.

[AOT] / wt. %	Temp to pHRR / °C	pHRR / (W g^{-1})	THR (kJ g^{-1})
0	385	349	25.1
0	384	326	22.7
0	383	339	24.4
CC / %	0.21	2.8	4.20
1	384	349	23.70
1	385	330	22.30
1	385	332	22.50
CC / %	0.15	2.53	2.72
9	388	318	22.10
9	389	304	22.30
9	388	285	22.10
CC / %	0.15	4.48	0.43
30	387	212	21.6
30	385	213	22.2
30	389	197	21.7
CC / %	0.42	3.54	1.21

[AOT] / wt. %	HRC / (J g^{-1} K^{-1})	Char / wt. %
0	345	0
0	324	2.02
0	334	4.90
CC / %	2.6	87.4
1	339	0
1	327	0
1	328	4.95
CC / %	1.65	141.42
9	316	1
9	301	0
9	281	9.9
CC / %	4.80	123.61
30	210	4.7
30	211	6.9
30	195	8.4
CC / %	3.57	22.68

References

[1] Blum, F.D., Young, E.N., Smith, G. & Sitton, O.C. Thermal analysis of adsorbed poly(methyl methacrylate) on silica. *Langmuir* **22**, 4741–4744 (2006).

[2] Ferriol, M., Gentilhomme, A., Cochez, M., Oget, N. & Mieloszynski, J. Thermal degradation of poly(methyl methacrylate) (PMMA): modelling of DTG and TG curves. *Polym. Degrad. Stab.* **79**, 271–281 (2003).