

Supplementary data

Mapping the multimodal action of Melamine-poly(aluminium phosphate) in the flame retardancy of polyamide 66

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Table S1. Solid state NMR data for additives, formulations and their degradation products

Additives/formulations	²⁷ Al (δ, ppm)	³¹ P (δ, ppm)	¹³ C (δ, ppm)
S200	39.2, 12.1, -17.7	0w, -10.3, -21.7, -24.4, -27.2, -30.8	164.9, 157.6
S200-395	38.8, 12.2w, -17.7	0, -12.6, -27,-31	163.7, 156.3
S200-545	39.3, 3.4, -17.0	-9.2br, -20, -29.4	164.2, 156.0
S200-750	39.5, -13.0w	0w, -13.7, -28.4	156br, 70br, 40br
AlPi+S200-323	37.7, -13.3, -18.8	42.9, 41.3, 40.8sh, -27.2, -30.7	8.3, 18-24m
AlPi+S200-430	38.2, 5.7w, -14.5	1.3w, -11.3, -27.3	20.6br, 7.3, 169.1w, 159.2 w
AlPi+S200-581	37.8s, 6.3w, -15.8w	-28.8br, 0w	Not visible
AlPi	-13.3	41.2, 42.9	8.3m, 20.2m
AlPi-452	38.3, -13.1, 7.2w	40.3, 43.0, 11.2, -26.7br	8.6m, 20.3br
PA66/GF+S200	54.1sh, 39.8, -17.9	-21.7, -24.3w, -10br -27.3, -30.9	173.2, 25.1m,42.3m
PA66/GF+S200-100	49.6, 38.7, -18.0	-27.2, -30.8, -36.2w	173.2, 25.2m,42.4m
PA66/GF+S200-300	51.3, 39.3, 5.7, -17.9	-27.2, -31, -36.4br	173, 127br, 29.7m, 39.2m
PA66/GF+S200-382	48.3, 38.1, -17.7	-27.1, -30.7	129.2br, 29.1m
PA66/GF+S200-460	50.4, 39.8, 4.6, -19.6	0, -33.2	128.3br, 27.9m
PA66/GF+S200-600	54.7, 48.0, -18.1, 9.1w	0w, -35.0br	127.2br, 28.8m
PA66/GF+AlPi	50.3, -12.2	42.8, 41.2	173.2, 7.6, 19.8m, 42.4m
PA66/GF+AlPi-600	52.5, 38.7, 14.1, -11.9	40.3, 42.8, 11.6, -11.7, -30.5	126w, 5.7, 20.3w
PA66/GF+AlPi+S200	53.7sh, 39.4, -12.2, -17.5	42.8, 41.1, -20.9w, -23.9w, -26.6w, -30.2w	173.6, 20.4-42.3m, 20.7, 7.6
PA66/GF+AlPi+S200-100	51.4, 38.9, 13.4, -12.2, -17.2	42.7, 40.5, -11w, -30.5	173.2, 25.1-43.1m, 19.7, 7.6
PA66/GF+AlPi+S200-300	53.7sh, 38.9, -11.9, -18.5w	42.8, 40.3, -30.7	173.4, 25.1-42.2m, 7.2, 14.3
PA66/GF+AlPi+S200-430	52.2sh, 39.2, -12.2, -16.7	42.7, 40.3	135br, 29.2, 14.0, 7.5
PA66/GF+AlPi+S200-600	51.5, 38.8, 13.8, -11.3w	-11.7w, -30.2	129br, 20br
PA66/GF+AlPi+S200-1000	51.6sh, 38.6	-30.7	129.3, 15br

w=weak; br= broad; sh= shoulder; m= multiplet

Table S2. X-ray powder diffraction data and FTIR spectral data (at RT) on selected compounds

Sample	Major Diffraction peaks 2 θ , (°)	Major bands in FTIR (cm ⁻¹)
S200	11.1, 12.7, 15.0, 15.4, 16.6, 18.3, 20.5, 21.5, 22.4, 22.8, 26.8, 28.2, 30.5, 34.9, 35.6	3395m, 3359m, 3157m, 3077m, 1673s, 1512m, 1409m, 1270m, 1128s, 1063s, 947m, 884s, 780m, 471s
S200-395	15.4, 20.5, 21.6, 22.8, 26.6, 30.5, 35.6	3440w, 3178m, 3043m, 1646s, 1558s, 1373s, 1233s, 1125vs, 946m, 786w, 718w, 463s
S200-545	20.4, 21.5, 35.5	3445w, 3217w, 1646m, 1472m, 1124vs, 938s, 814w, 719w, 468s
S200-750	20.7, 21.8, 35.8	1118vs, 943m, 726w, 464s
PA66/GF+S200-1000	20.7, 21.5, 35.4w	1115s, 918m, 720w, 441s
PA66/GF+AlPi+S200-1000	20.4, 21.5, 35.6w	1124s, 938m, 709w, 458s

s=strong, w=weak, m=medium intensity