Nanostructurant additives improve the thermal properties of polymers, increasing the degradation temperature, decreasing the heat release peak (HRR) and forming a char layer.

Results of laboratory tests conducted on polyethylene with modified hydrotalcite and zirconium phosphate additives are reported below:

The characterization of the samples was carried out using thermogravimetrical analysis (TGA) and cone calorimeter measurements.

	$T_{0.05}$ onset (°C)	$T_{0.50}$ midpoint (°C)	Residue (% wt)
PE	335	413	0
PE in N_2	444	482	0.2
PE + 5wt% zirconium P&T	368 (+33)	471 (+58)	3.9
PE + 5wt% hydrotalcite P&T	404 (+69)	436 (+23)	2.8

$T_{0.05}$ = degradation temperature of 5wt% of composite material
$T_{0.50}$ = degradation temperature of 50wt% of composite material

	PHRR (KW/m^2)	Combustion time (s)
PE	1200	470
PE + 5wt% zirconium P&T (1)	792 (-34%)	750 (+280)
PE + 5wt% hydrotalcite P&T (2)	370 (-71%)	760 (+290)

Cone calorimeter tests were carried out irradiating the materials at 50 KW/m^2.
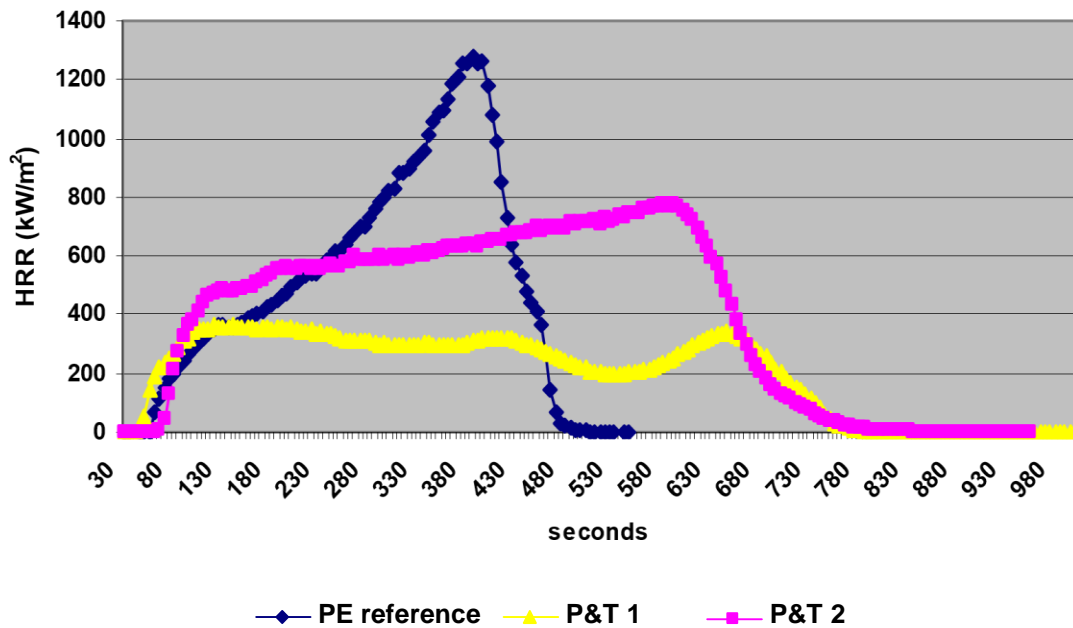
Heat Release Rate curves as a function of the temperature for the indicated samples.

Image of a test sample based on PE containing 5wt% of P&T additive during the combustion. In the image the formation of char on the surface of the sample is clearly visible. This char layer is able to decrease the oxygen diffusion and the Peak of Heat Release Rate (PHRR) up to 70% compared with the neat PE polymer.

Some combustion residues of composite samples with evident char formation.