

TOLSA

Special Additives Business Unit

Flame Retardancy

June 2018



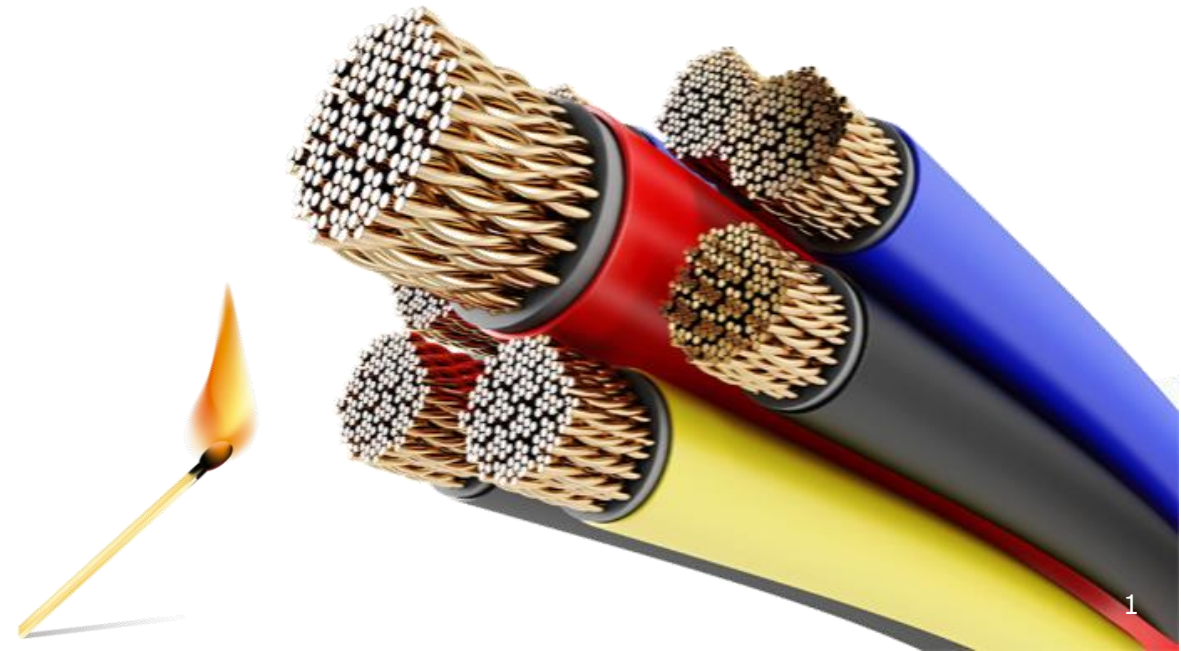


ADINS

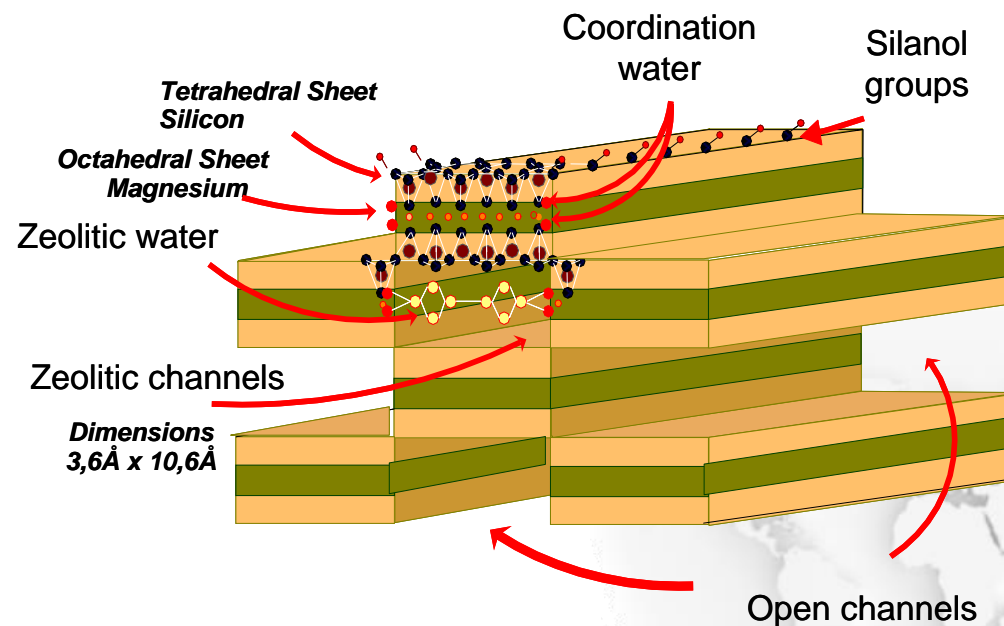
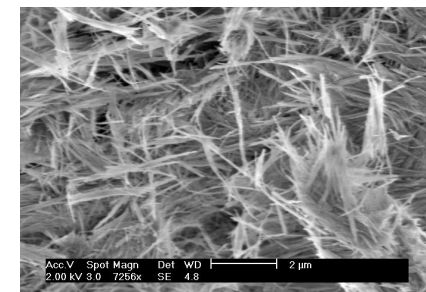
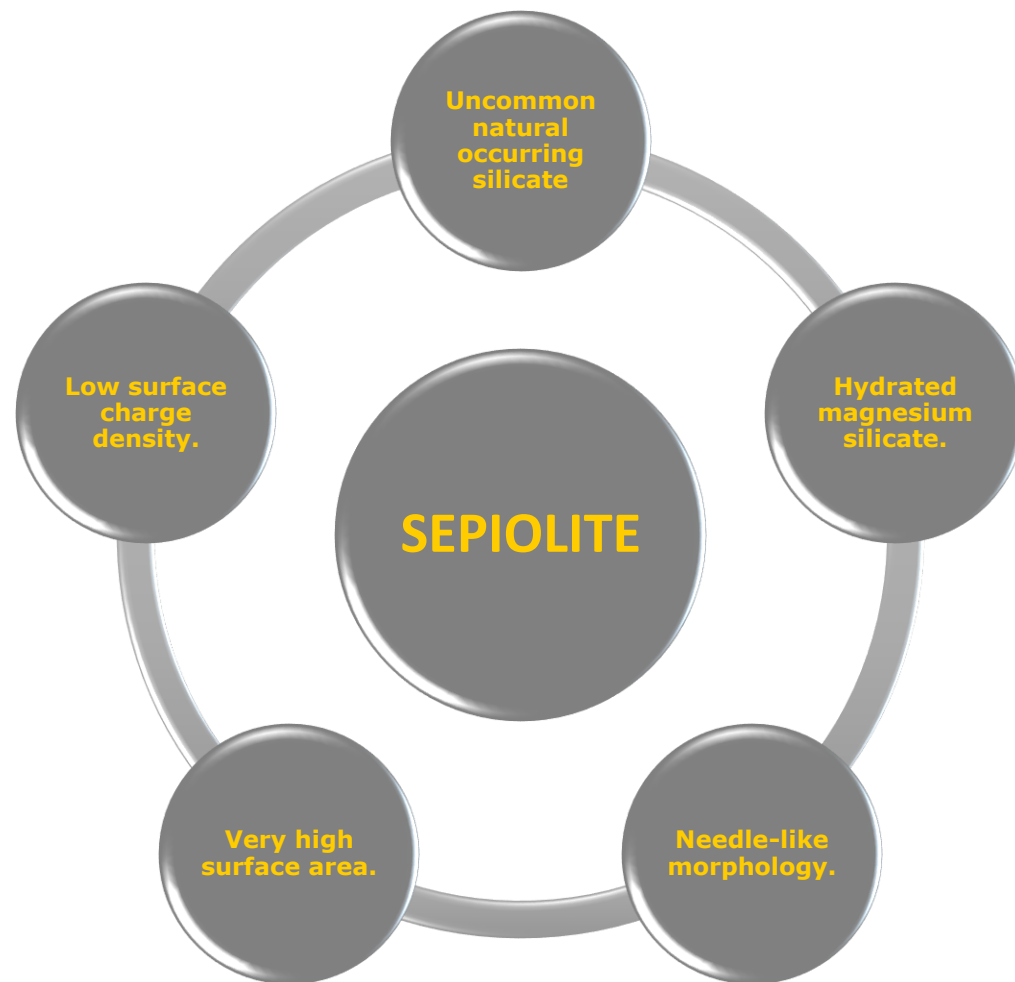
Better Additives Inside

flame retardancy

- Flame Retardancy
- Ceramifiable Surfaces



TOLSA Special Additives



TOLSA Special Additives



- **ADINS Additives Treated at 1000°C**

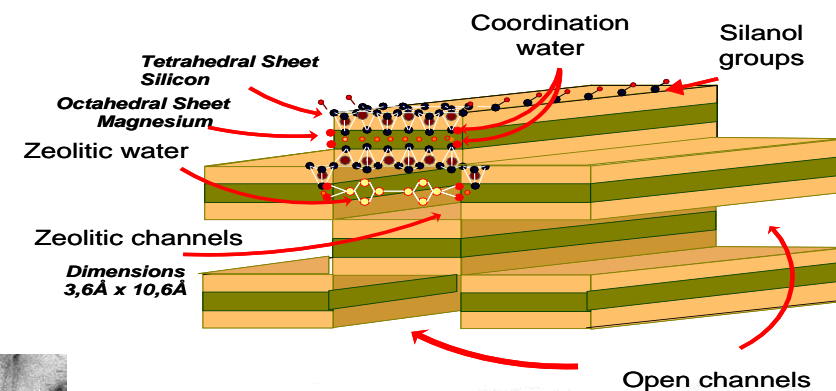
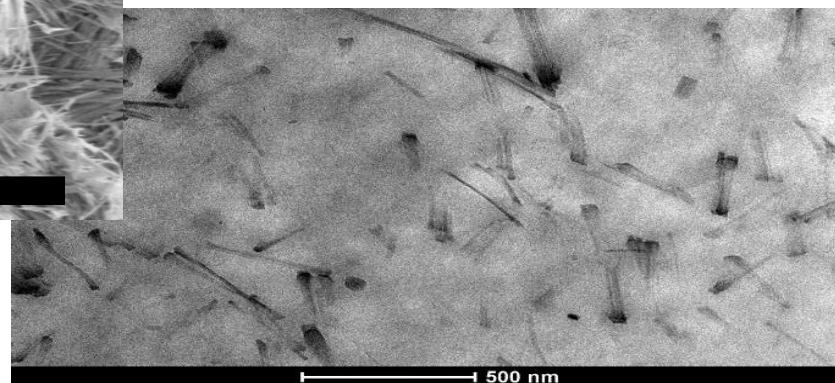
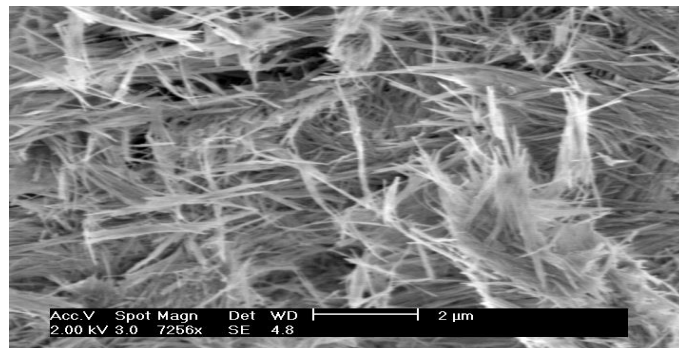




How can ADINS help in FR systems?

ADINS additives, which technology is based in the functionalization of sepiolite, a natural uncommon silicate with fibrillar structure and high specific surface area, allows to improve the fire performance :

- Flame spread-Dripping
- Heat release
- Smoke production





How can ADINS help in FR systems?

POLYMER

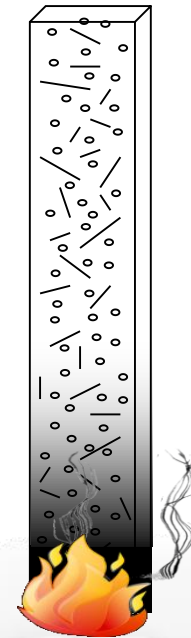
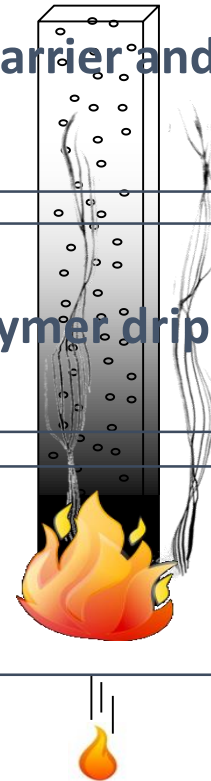
POLYMER + FR

POLYMER + FR + ADINS

Enhances char structure, improving gas barrier and mechanical properties

Avoids flame propagation by burning polymer dripping

Reduces the smoke production

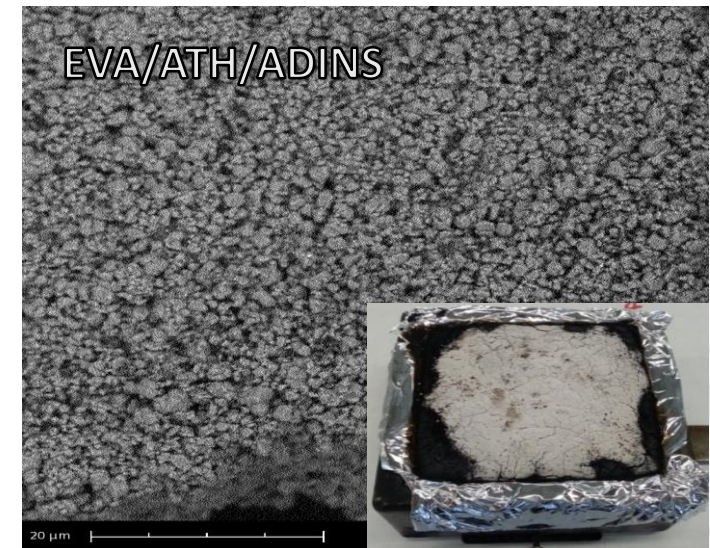
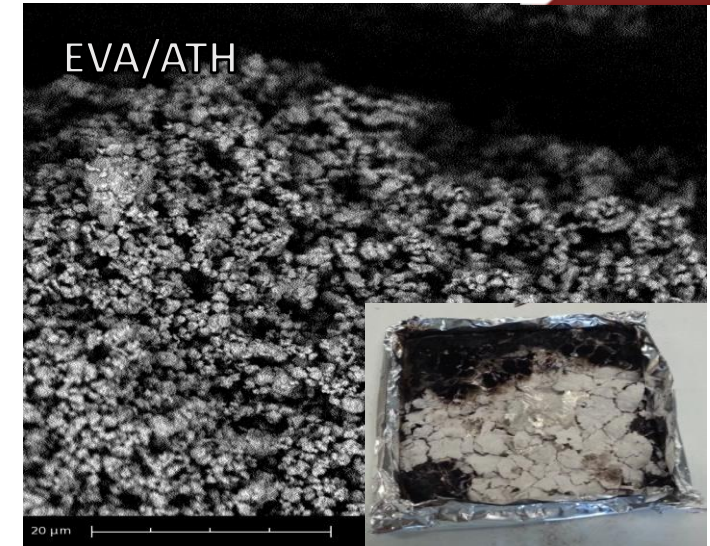


Char formation

Enhances char structure, improving gas barrier and mechanical properties

An enhancement of the char structure leads to a reduction of the heat release due to:

- Thermal stabilization of the polymer
- Creation of a heat barrier that protects fresh polymer from burning
- Reduction of organic flammable volatiles emission
- Reduction of the penetration of oxygen into the decomposition zone of the polymer

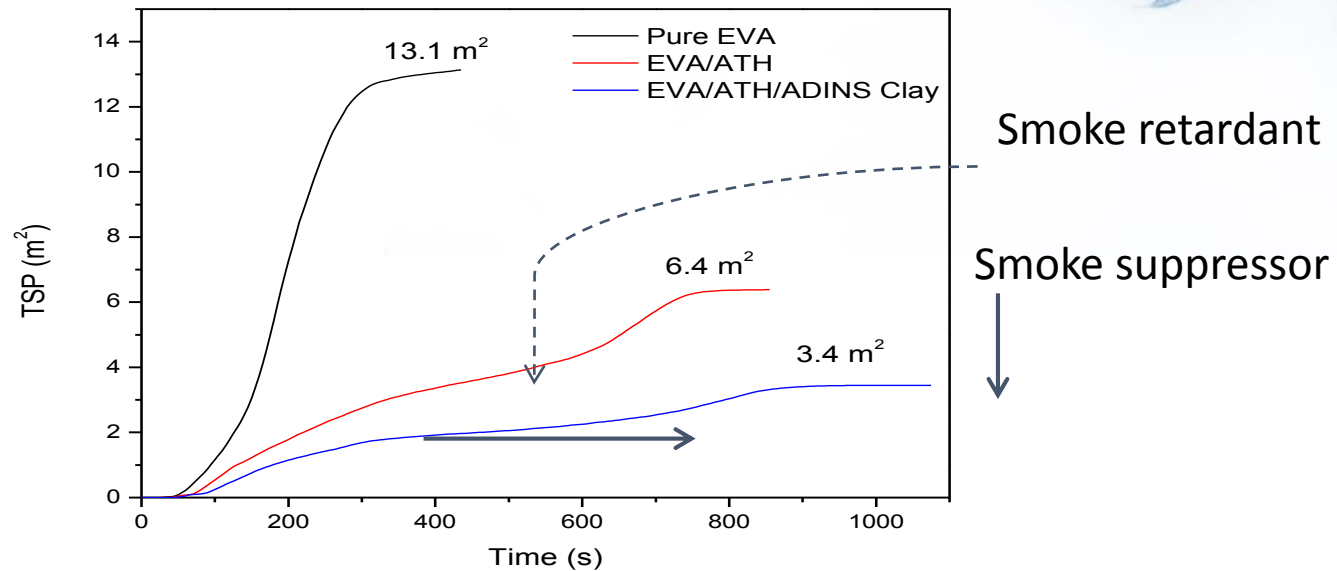


Smoke Production



Reduces the smoke production

The enhancement of the char structure leads also to a reduction and a time delay of the smoke production.



TOLSA Special Additives



➤ ADINS clay – Flame retardancy

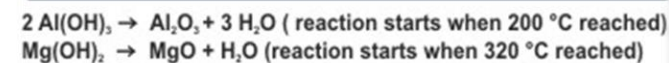
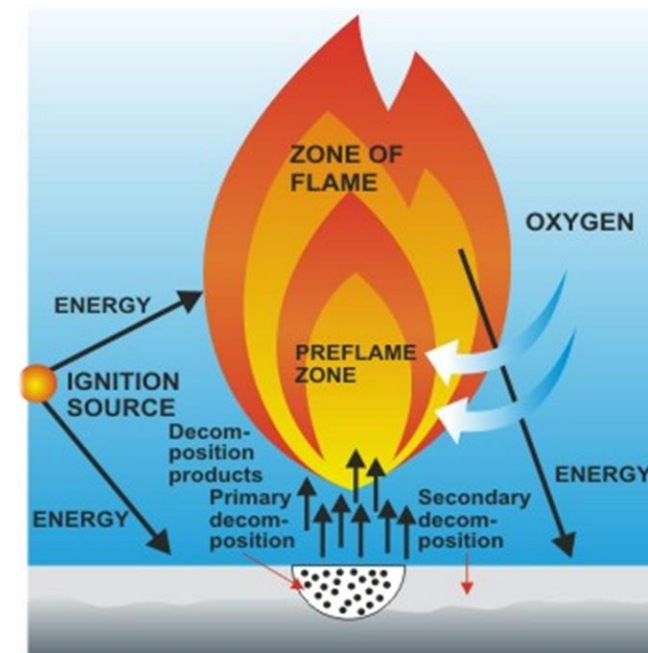
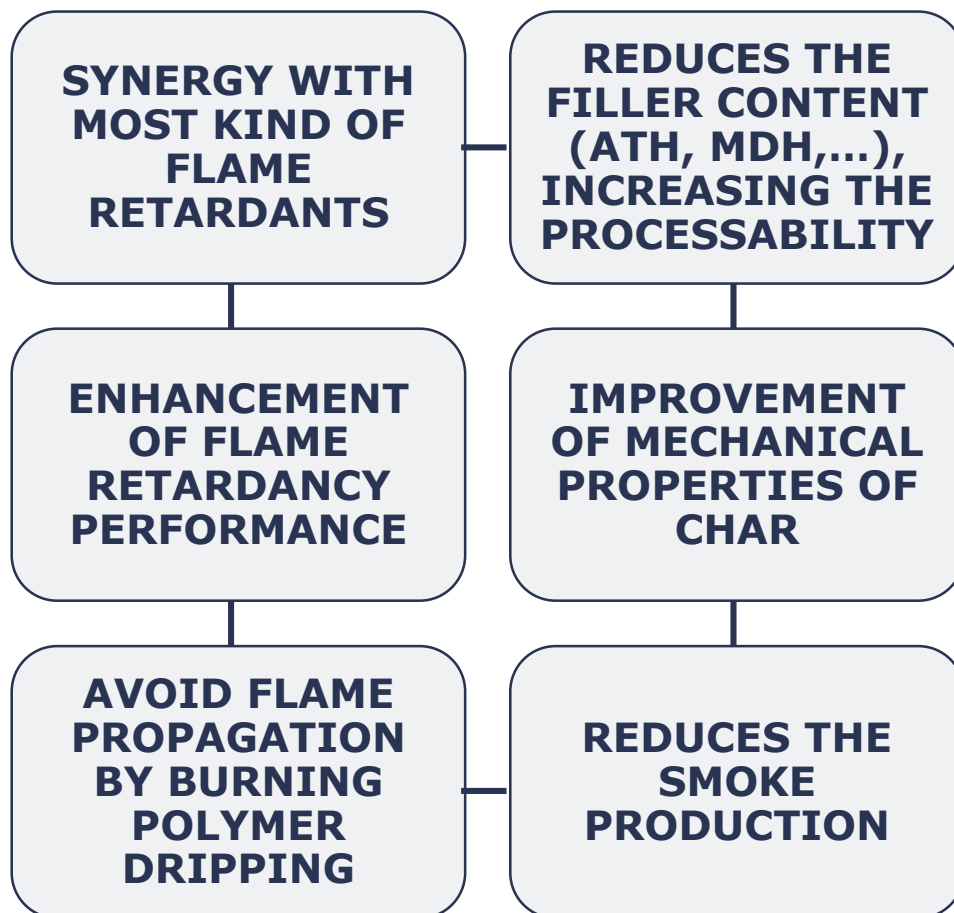
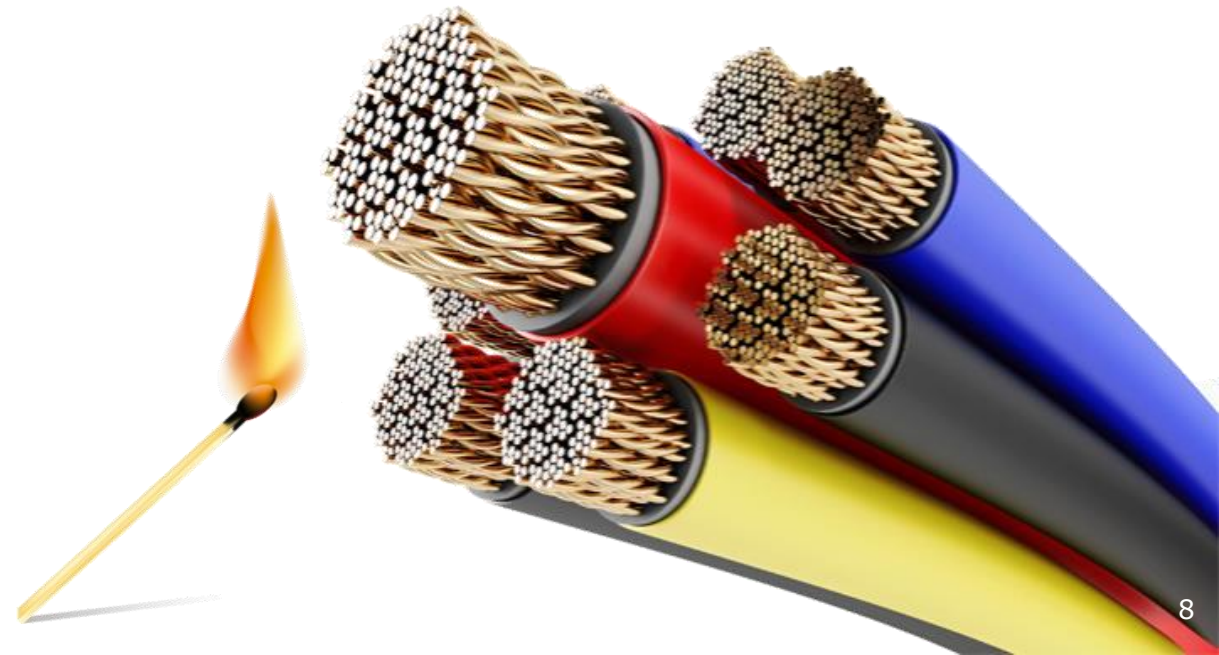


Fig.1: Working mechanism of mineral flame retardants [1]



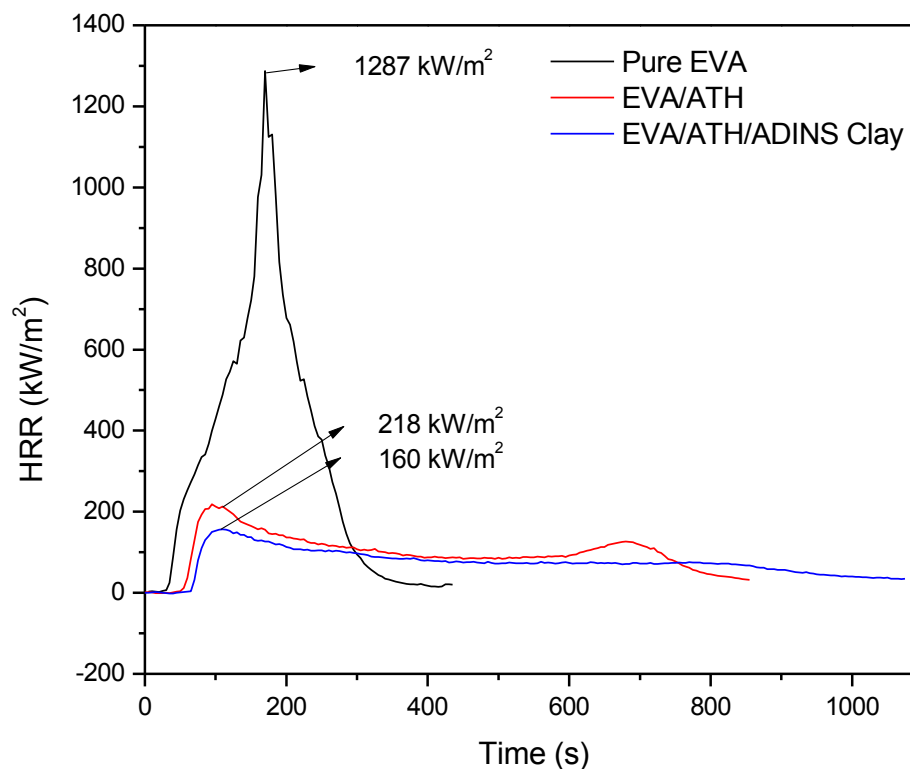
EVA-FR SYSTEM





➤ EVA/ATH

Burning Behaviors – Cone Calorimeter test



	A	B
EVA	35	26
ATH	65	62
MB	--	12 (3clay+9EVA)

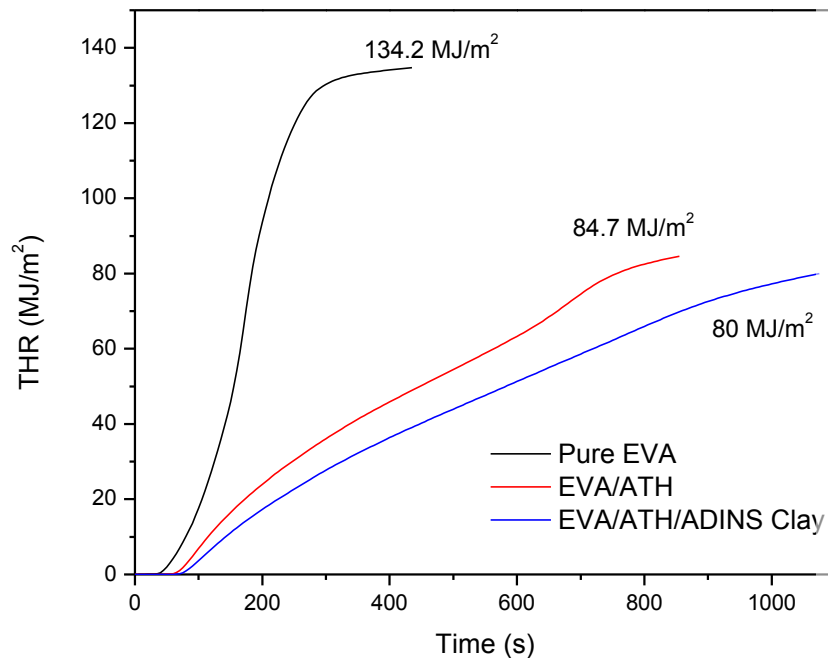
* EVA density : 1,2 g/cc MFI: 3,78 g/10 min

- ❑ Pure EVA burns very rapidly after ignition and the PHRR is 1287 kW m⁻²
- ❑ Incorporating 65 wt% ATH significantly decreases the PHRR to 218 kW m⁻²
- ❑ Replacing part ATH by 3 wt% clay leads to a further decrease in PHRR (160 kW m⁻²)

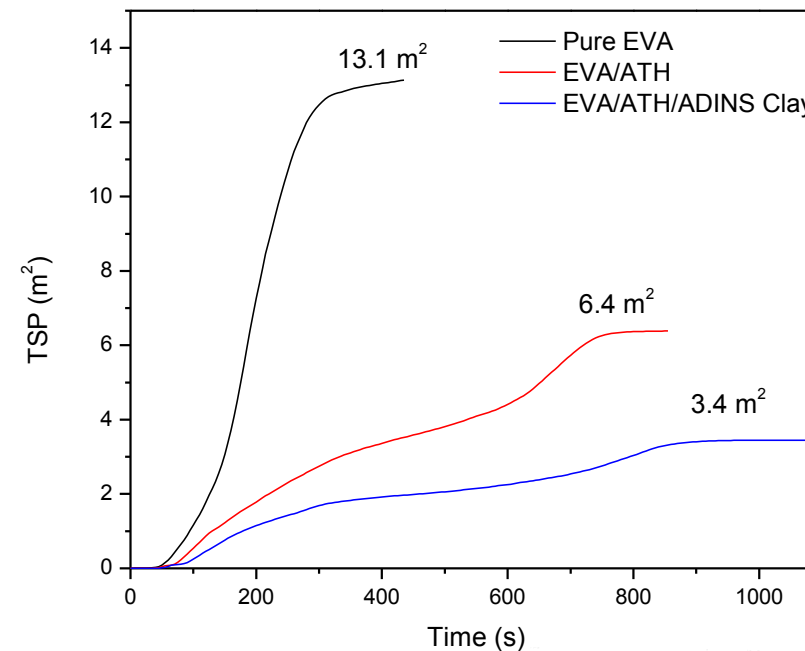


➤ **EVA/ATH**

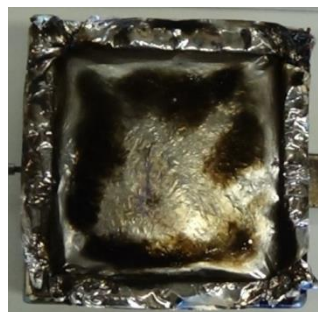
Total Heat Release



Total Smoke Production



Pure EVA



EVA/ATH

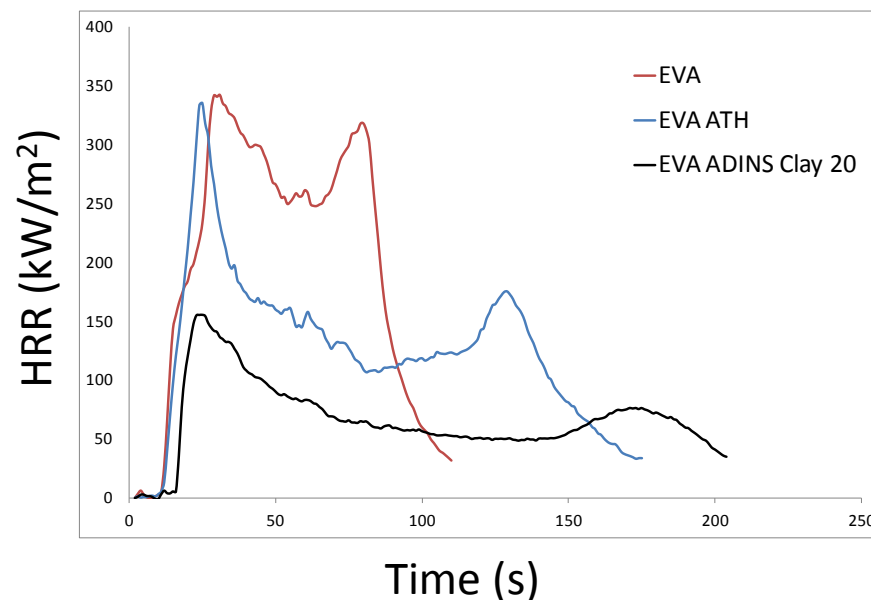


EVA/ATH/ADINS





➤ EVA/ATH



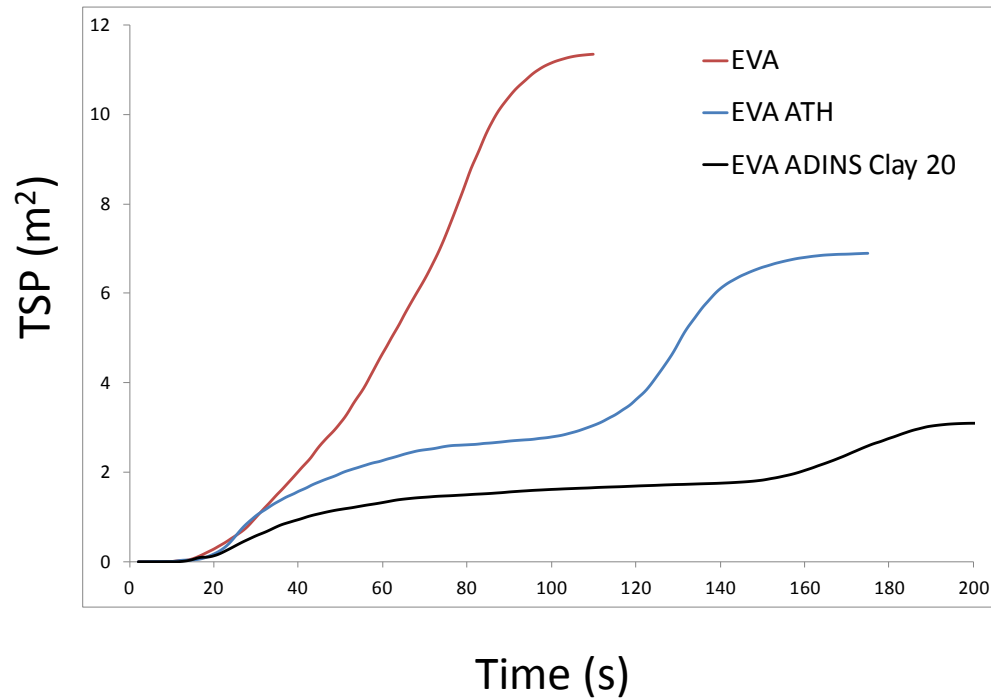
* EVA Alcludia PA539: V.A. content 18%, 0,937 g/cc MFI: 2,0 g/10 min

Sample	PHRR (kW/m ²)	THR (MJ/m ²)	TSP (m ²)	TSR (m ² /m ²)	LOI (%)
EVA/ 65 %ATH	335 ± 74	109.2 ± 3.0	6.9 ± 0.4	779 ± 50	28.0
EVA/62 %ATH/3% ADINS CLAY 20	156±1	67±4	3.0±0.3	340±33	35.6

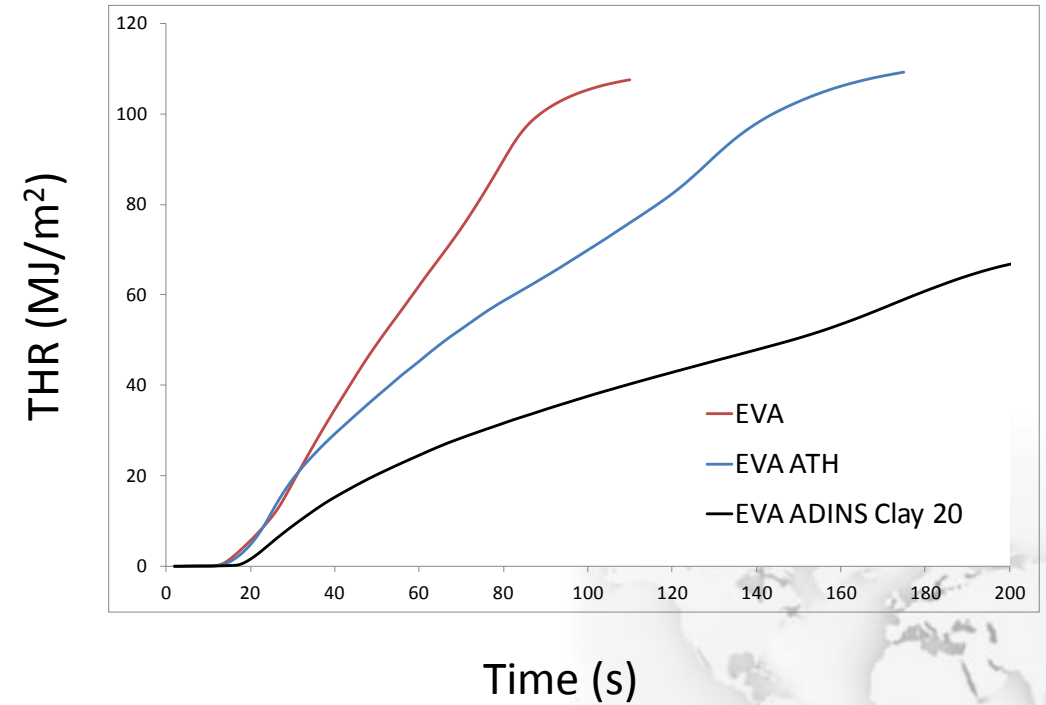


EVA/ATH

Total Smoke Production



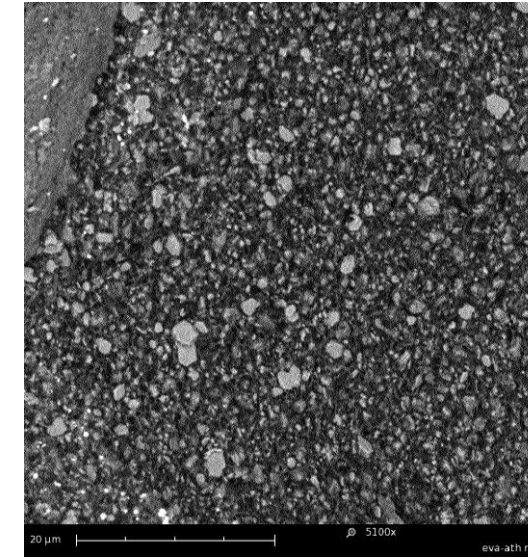
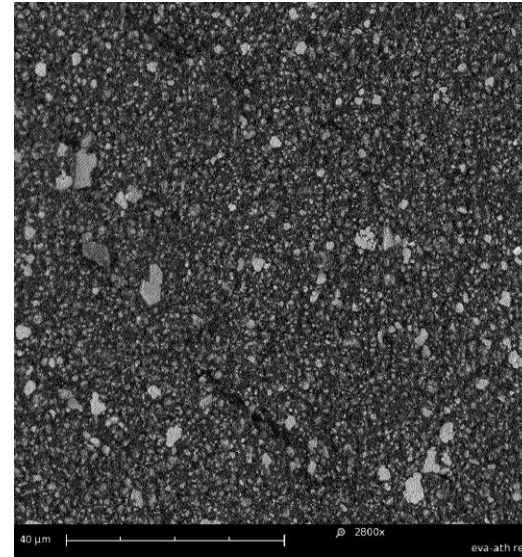
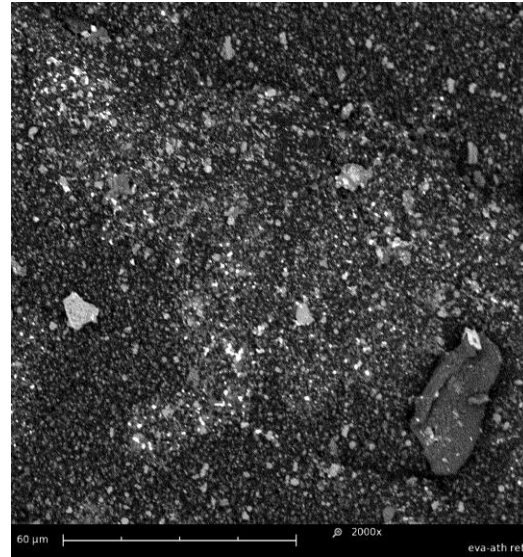
Total Heat Release



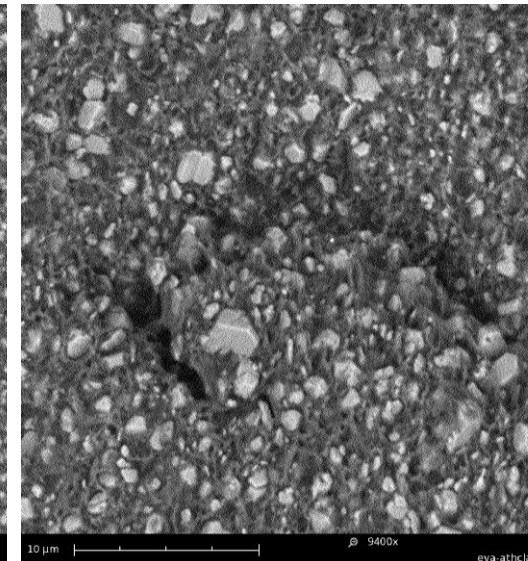
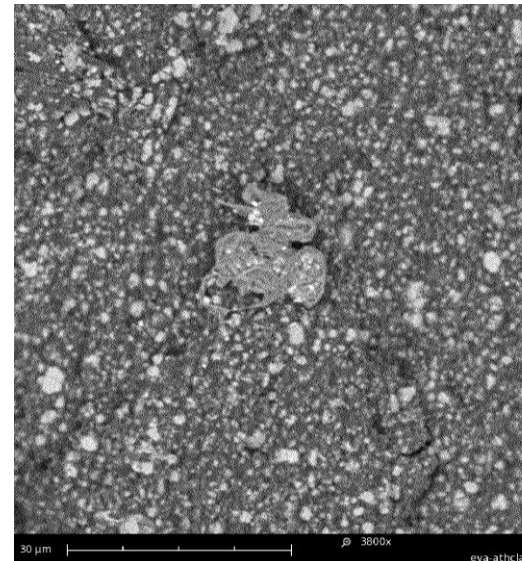
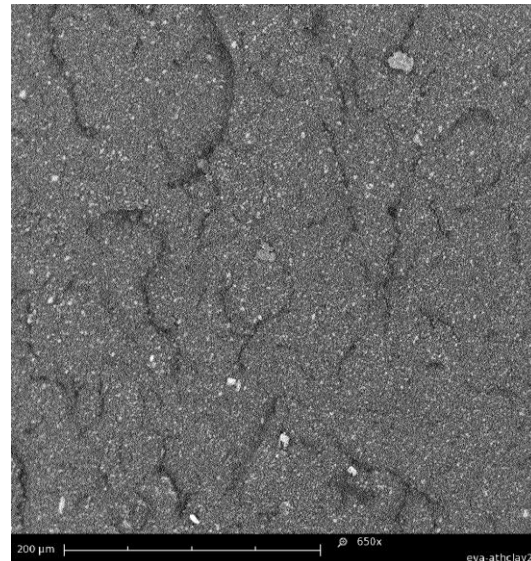
TOLSA Special Additives



**EVA + 65%
ATH**



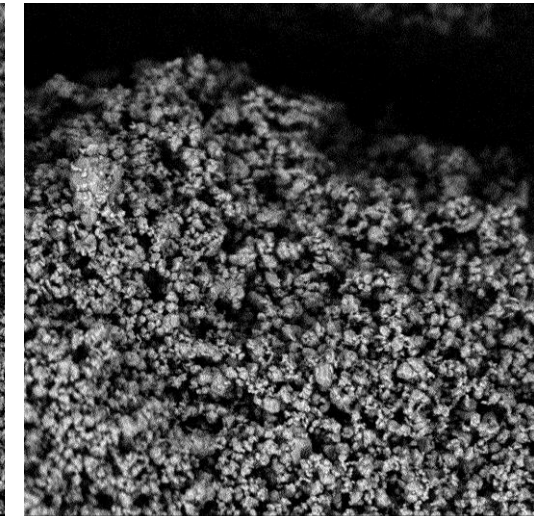
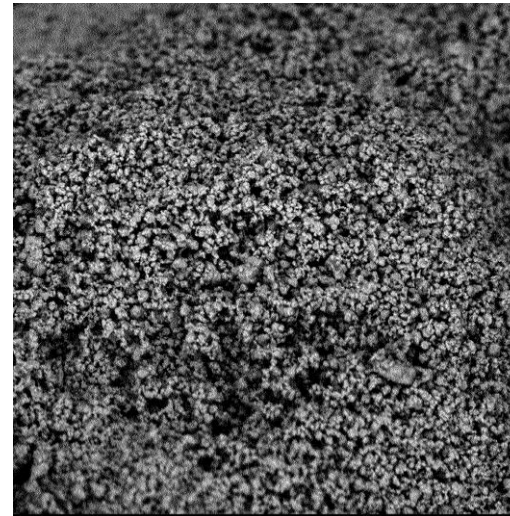
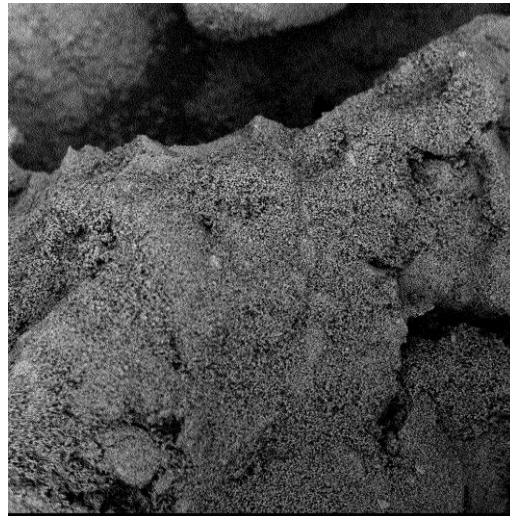
**EVA + 60%
ATH +
5%ADINS
Clay 20**



TOLSA Special Additives

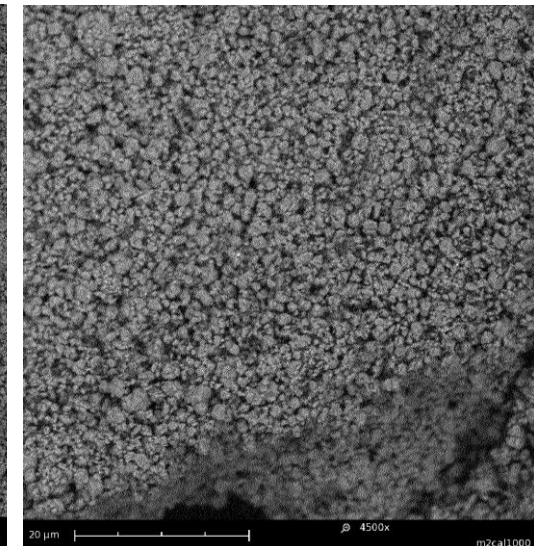
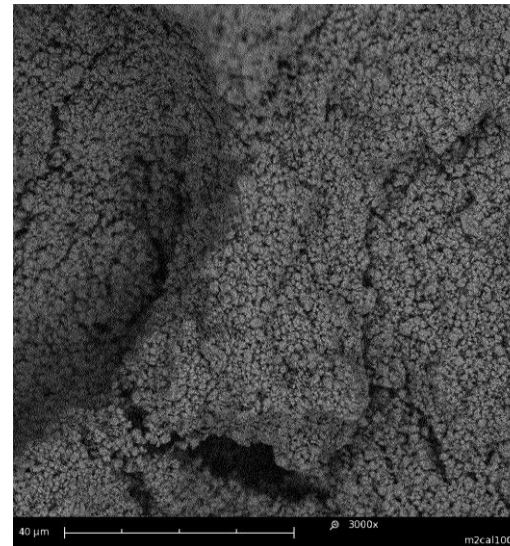
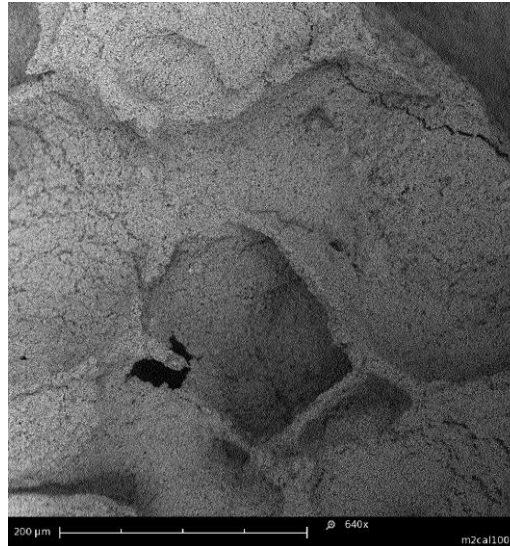


**EVA + 65%
ATH**



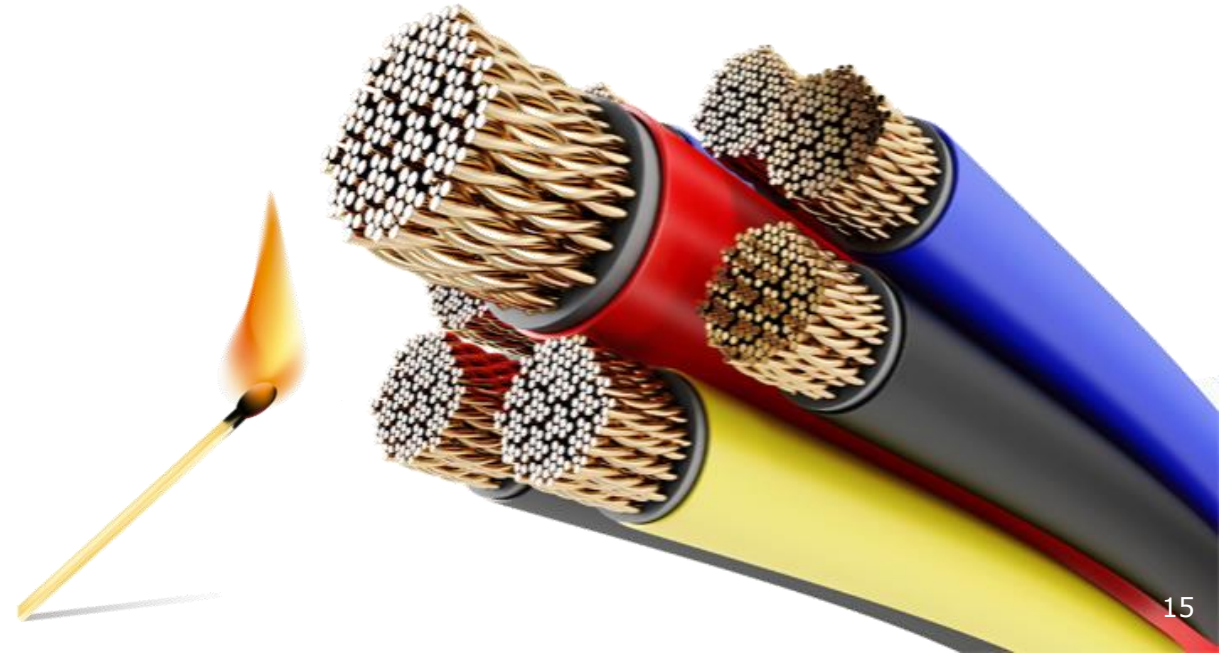
**Treatment
at 1000°C**

**EVA + 60%
ATH +
5%ADINS
Clay 20**



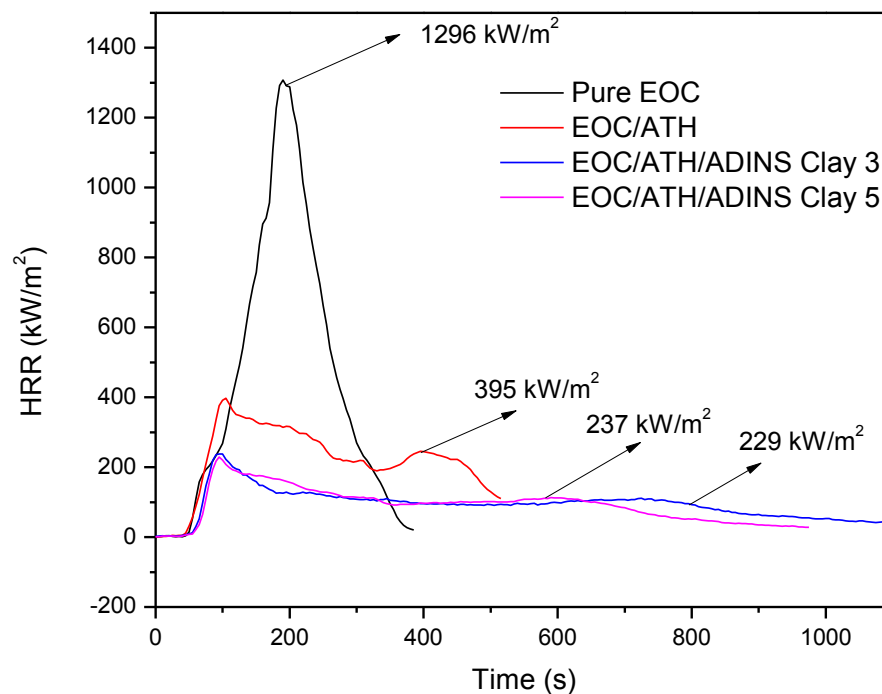


ETHYLENE/OCTENE -FR SYSTEM





➤ EOC/ATH



	A	B	
EOC	35	29	23
ATH	65	59	57
ADINS**	--	3	5

*EOC Density: 0,89 g/cc MFI: 10 g/10 min

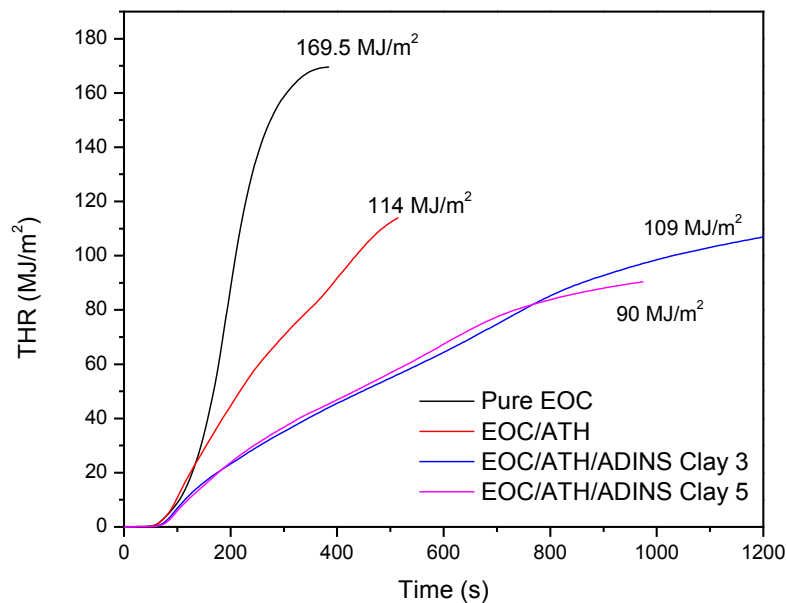
**MB: ADINS Clay + MAH-PE

- ❑ Pure EOC burns very rapidly after ignition and the PHRR is 1296 kW m⁻²
- ❑ Incorporating 62 wt% ATH into EOC decreases the PHRR to 395 kW m⁻²
- ❑ Replacement of part ATH by 3 wt% Clay leads to a reduction of PHRR to 229 kW m⁻²
- ❑ Further increase of Clay loading to 5 wt% shows a slight change in PHRR

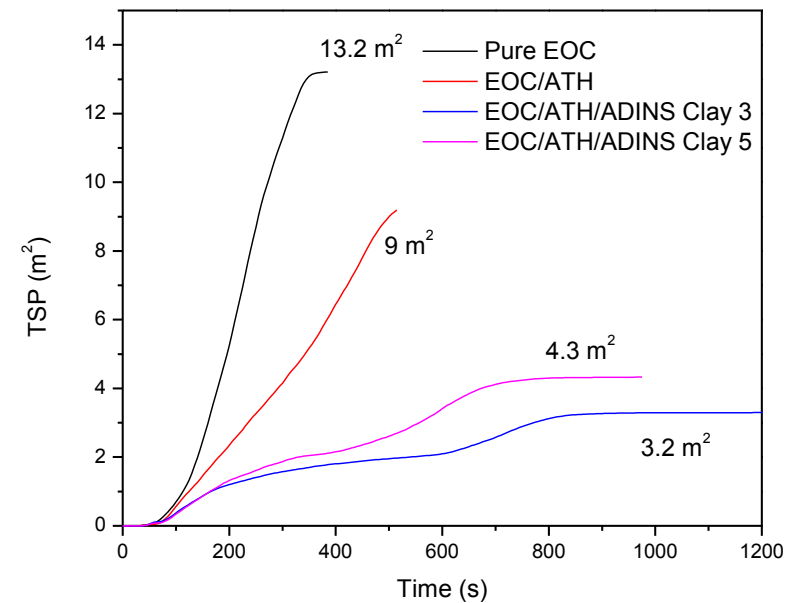


➤ EOC/ATH

Total Heat Release



Total Smoke Production



Pure EOC



EOC/ATH



EOC/ATH/Clay 3



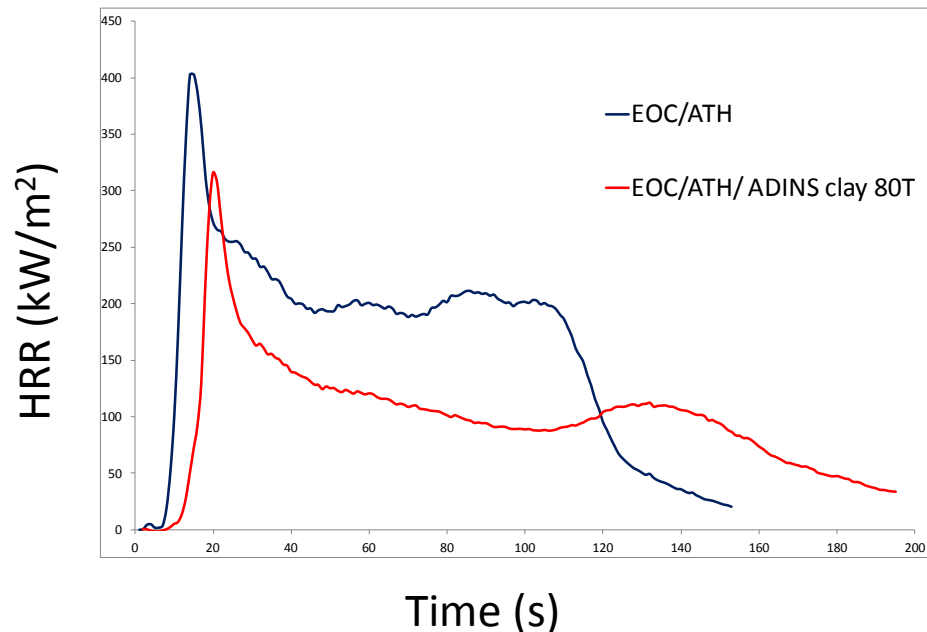
EOC/ATH/Clay 5



TOLSA Special Additives



➤ **EOC/ATH**



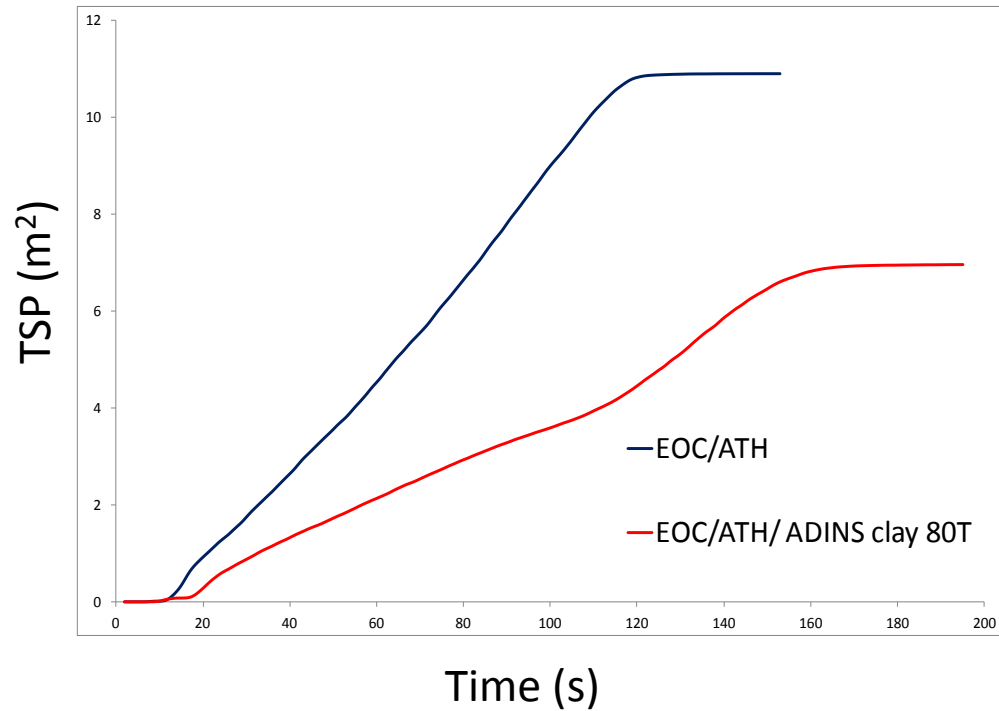
* EOC Engage 8003 (DOW)

Sample	PHRR (kW/m ²)	THR (MJ/m ²)	TSP (m ²)	TSR (m ² /m ²)	LOI (%)
EOC/ 60 %ATH	403± 68	125±21	10.8±2.9	1232±324	21.5
EOC/57 %ATH/3% ADINS CLAY 80T	315±3	95±8	6.9±2.7	780±303	26

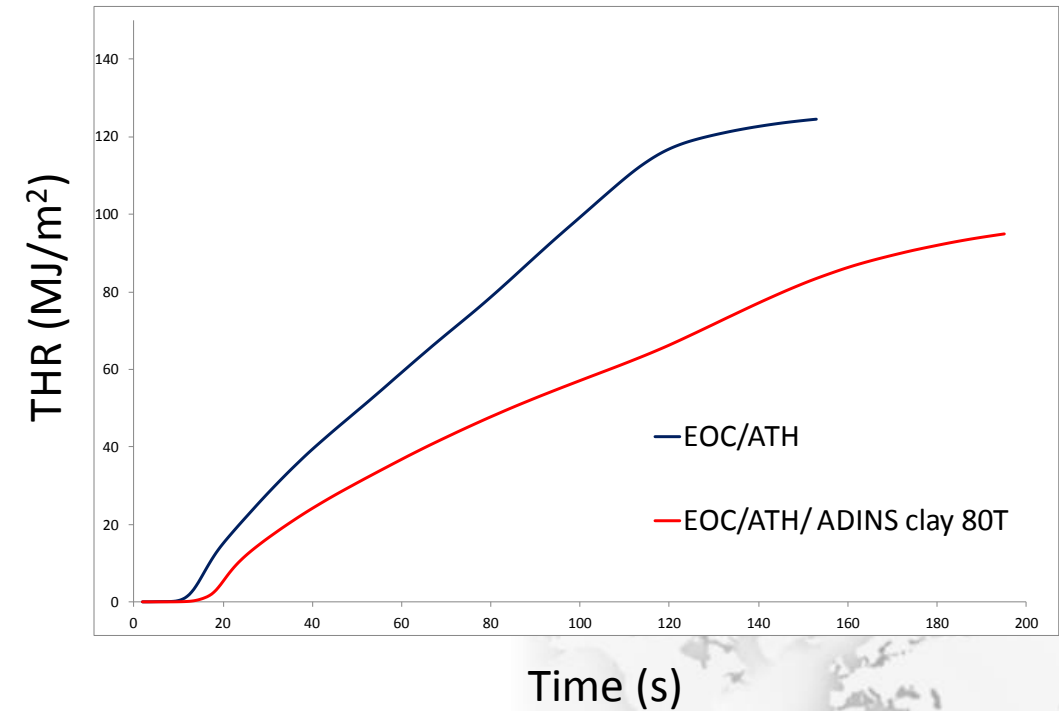


➤ EOC/ATH

Total Smoke Production

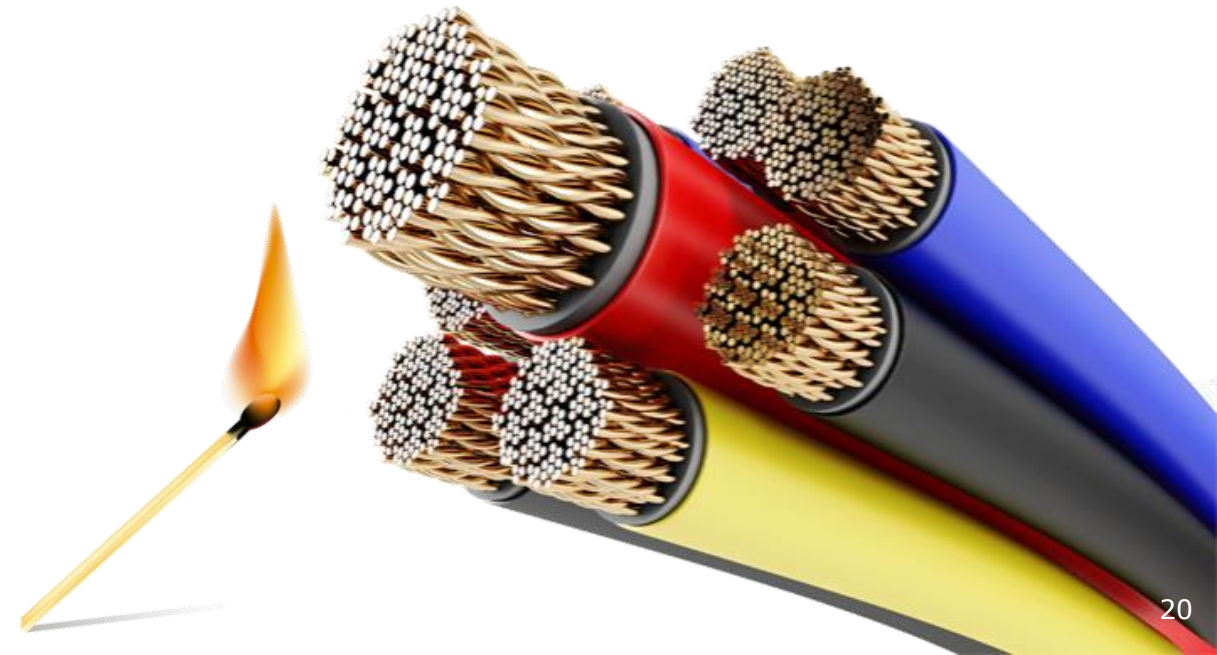


Total Heat Release





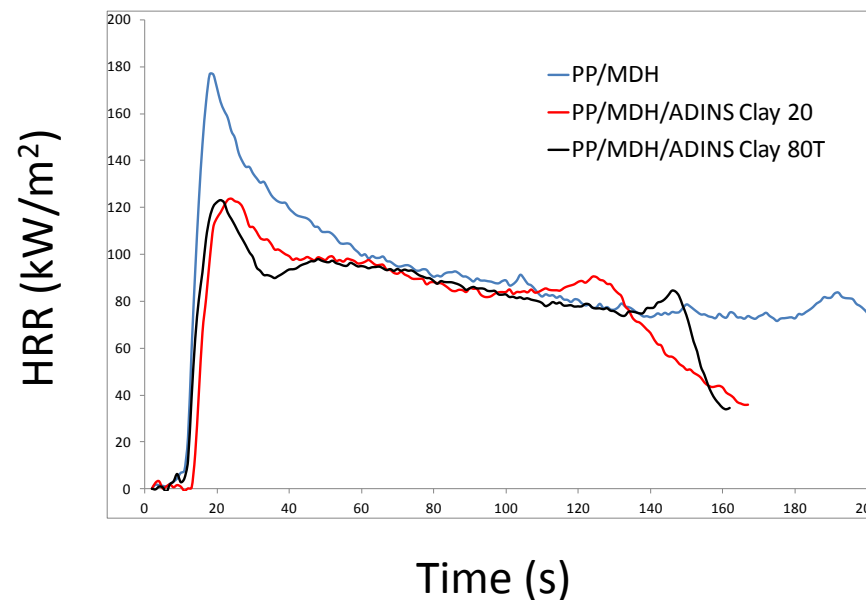
PP-FR SYSTEM





TOLSA Special Additives

➤ PP/MDH



•PP ISPLEN PP045 (Repsol): 0,905 g/cc MFI: 4,0 g/10 min

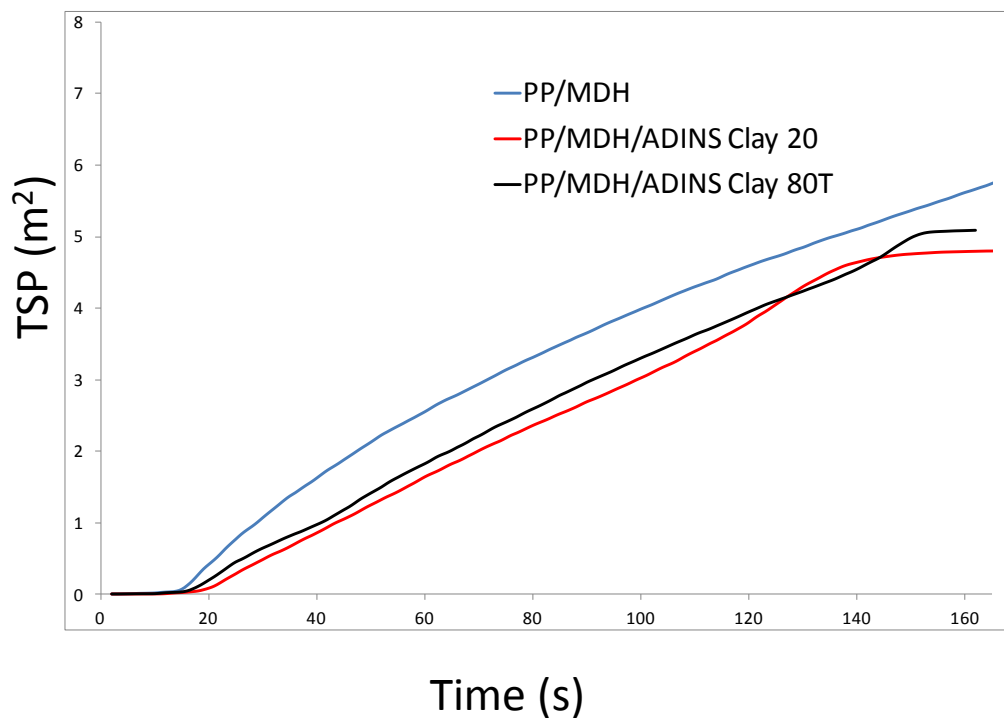
Sample	PHRR (kW/m ²)	THR (MJ/m ²)	TSP (m ²)	LOI (%)	UL-94
PP/ 60 %MDH	177±4	92±2	7.0±0.5	25.6	No Rating
PP/57%MDH/3% ADINS CLAY 20	124±7	64±3	4.8±0.3	30.6	V-0
PP/57%MDH/3% ADINS CLAY 80T	123±9	64±5	5.1±0.2	27.4	V-1

TOLSA Special Additives

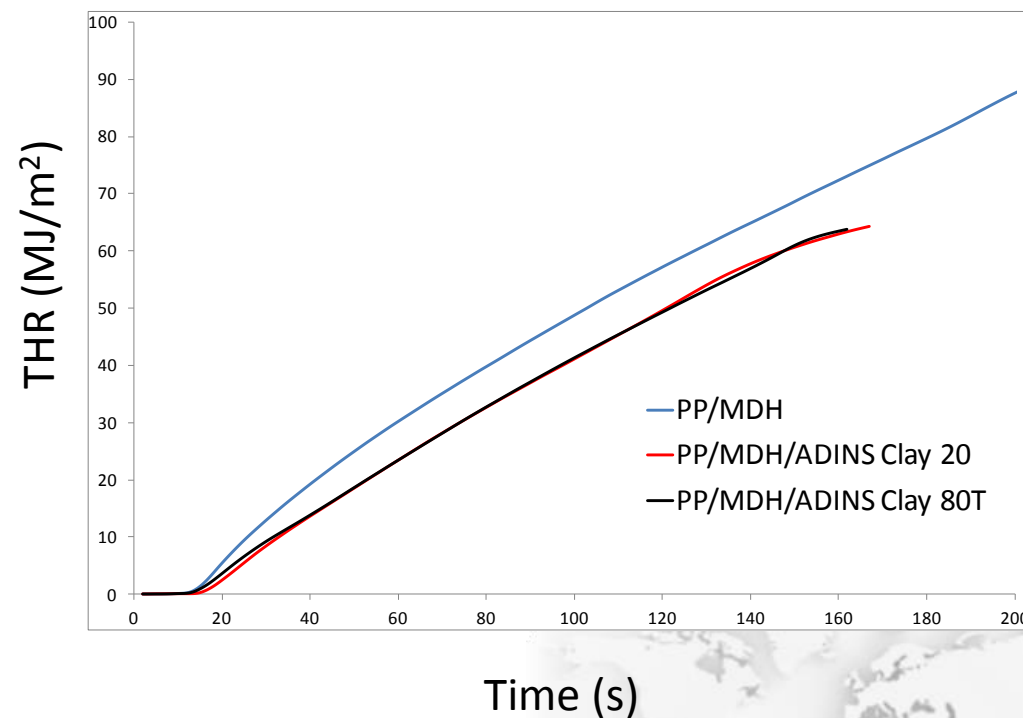


➤ PP/MDH

Total Smoke Production



Total Heat Release





➤ ADINS Clay – Intumescent: Performance in PPh

Burning Behaviors – UL-94 and LOI Tests (3.2 mm)

Samples					UL-94	LOI	PHRR
PP Homopolymer (%)	Intumescent (%)	ADINS Clay (%)	AOX (%)	PTFE (%)	Rating	(%)	(kW/m ²)
79.75	20		0.25		V-2	32.3	307
79.55	20		0.25	0.2	V-0	29.9	247
77.75	20	2	0.25		V-0	32.1	212
77.55	20	2	0.25	0.2	V-0	32.7	198
81.6	18		0.225	0.18	V-0	30	232
83.64	16		0.2	0.16	No Rating	28.2	368
79.79	18	1.8	0.225	0.18	V-0	30.2	192
82.04	16	1.6	0.2	0.16	V-1	29.3	247

PP homopolymer ISPLEN PP070G2M MFI: 12 g/10 min

AOX: Antioxidant

PTFE: Antidripping

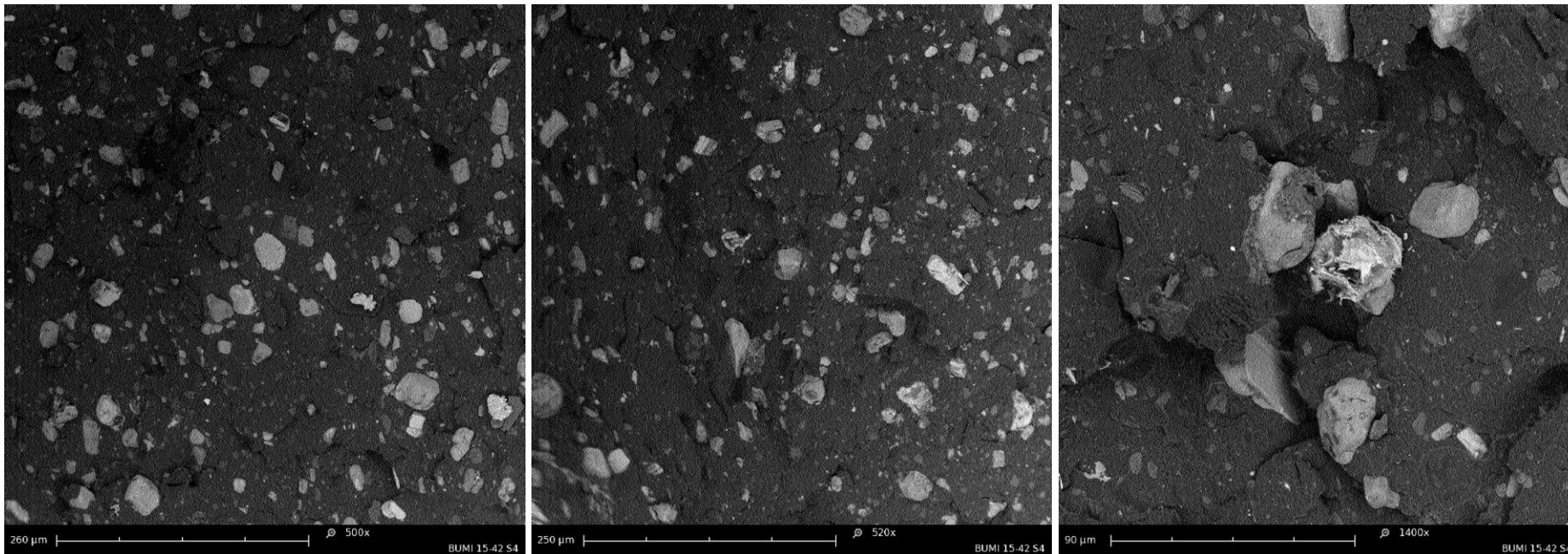
Cone Calorimeter test (50 kW/m²)

[See video](#)



➤ ADINS Clay – Intumescent: Performance in PPh

PP+ 25% APP+2% ADINS Clay 20

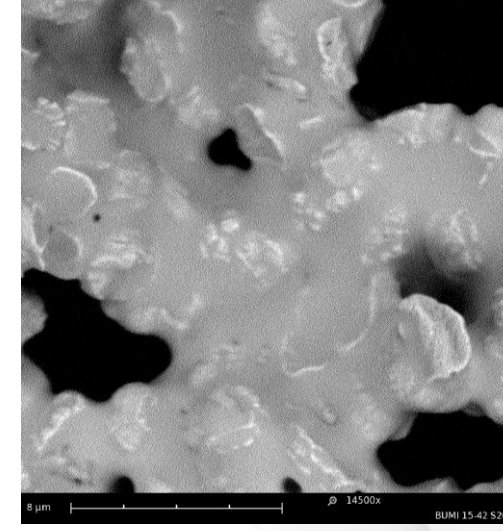
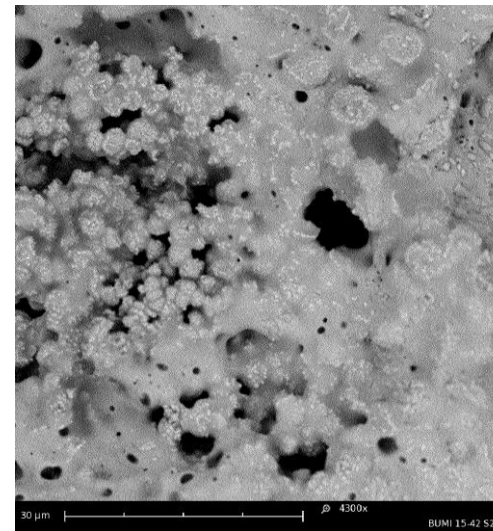
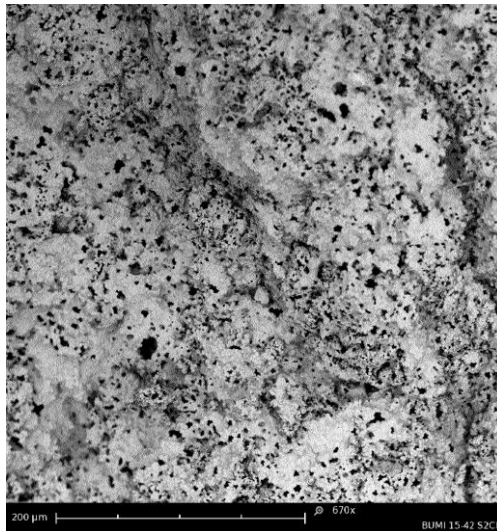
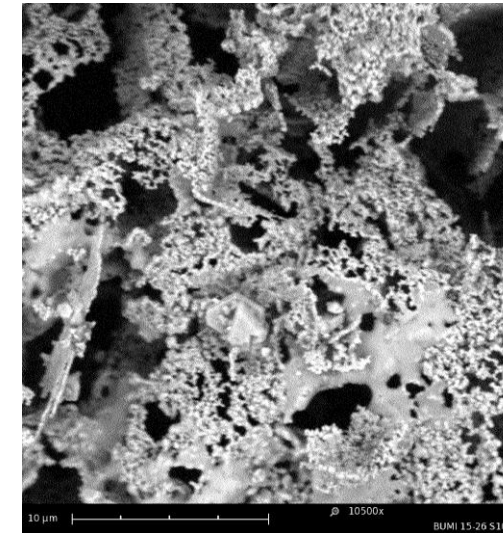
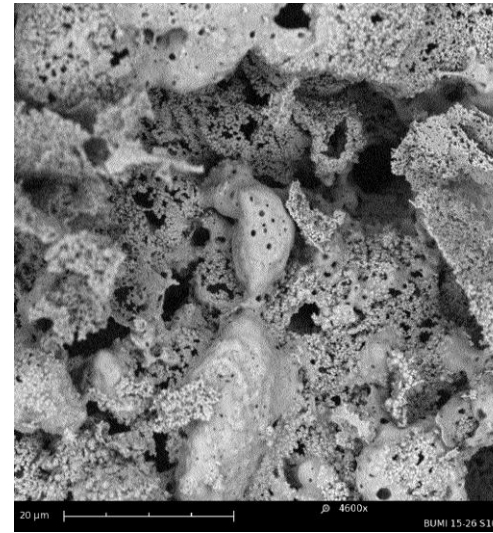
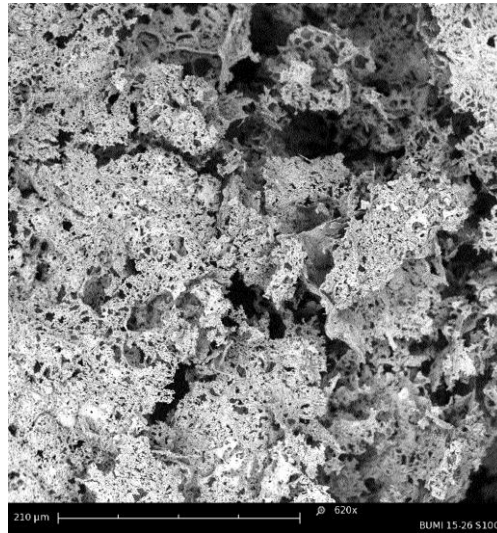


TOLSA Special Additives

**PP + 25%
APP**

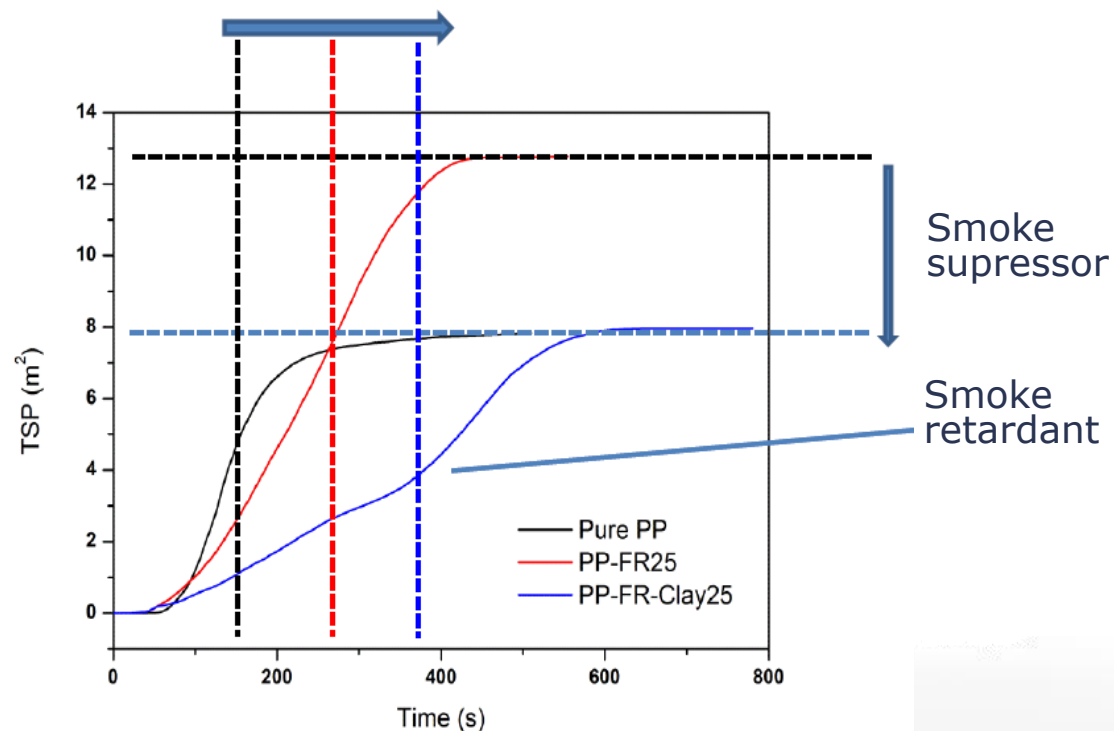
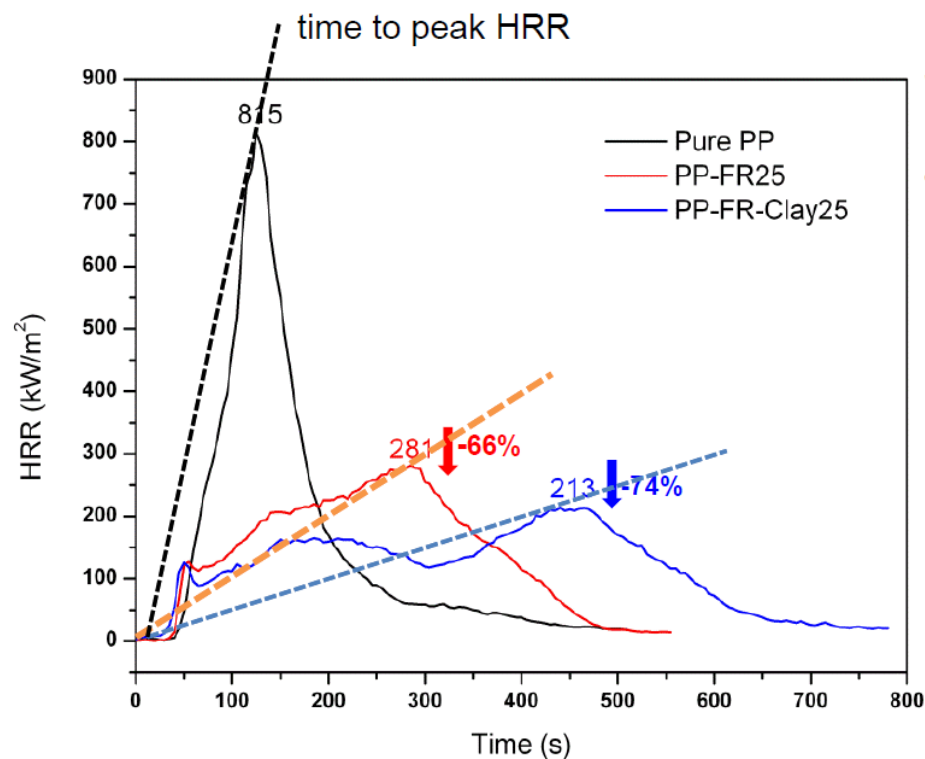
**Treatment
at 700°C**

**PP + 25%
APP
+ 2%ADINS
Clay 20**





➤ ADINS Clay – Intumescent: Performance in Co PP

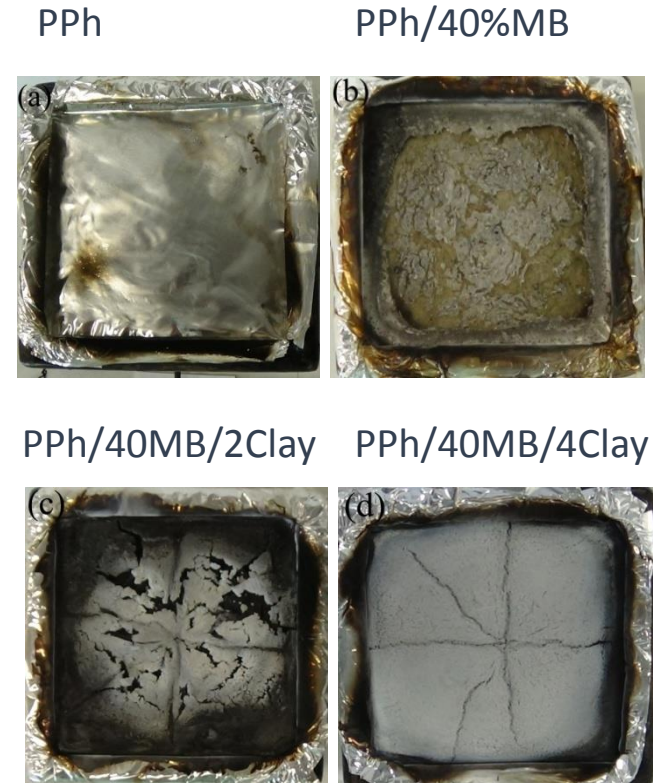
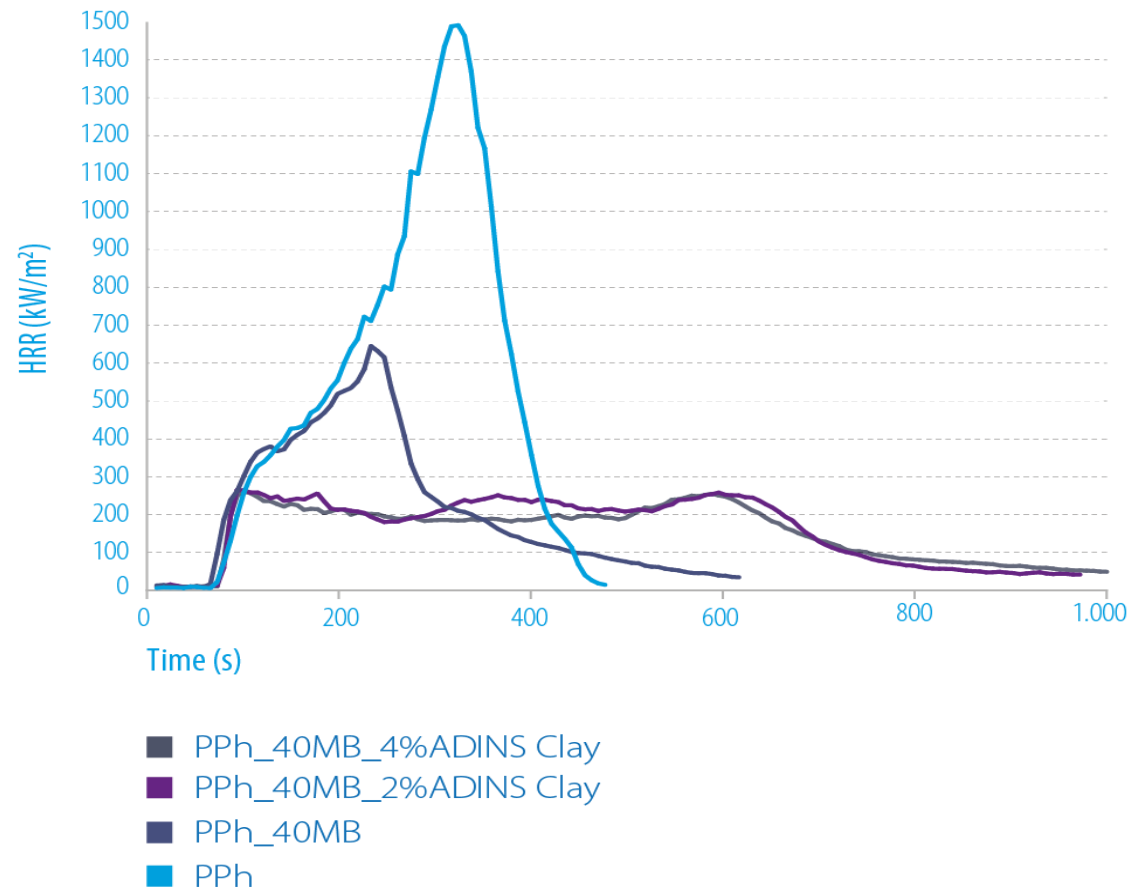


Total Smoke Production

- PP-FR-Clay25 (23 wt% Intumescent and 2 wt% Clay 20)
- Heat Release Rate at 35 kW/m².

TOLSA Special Additives

➤ ADINS Clay – Halogen FR: Performance in PPh



40%MB (LDPE + 50%DBDPE + 25%ATO)



➤ ADINS Clay – Halogen FR: Performance in Co PP

Samples	REF -1 (%)	REF -2 (%)	ADINS Clay (%)
PP copo	53.7	63.7	54.1
Decabromodiphenyl Ethane	22	22	19.5
ADINS Clay 20			2.0
ATO MB (80%)	7.5	7.5	7.5
Talc MB (60%)	16.7	6.7	16.7
AOX	0.2	0.2	0.2

Samples	PHRR (kW/m ²)	THR (MJ/m ²)	Average HRR (kW/m ²)	SP (m ²)
REF -1	446	57.7	287	636
REF -2	738	64.7	344	1009
ADINS Clay	279	63	196	430





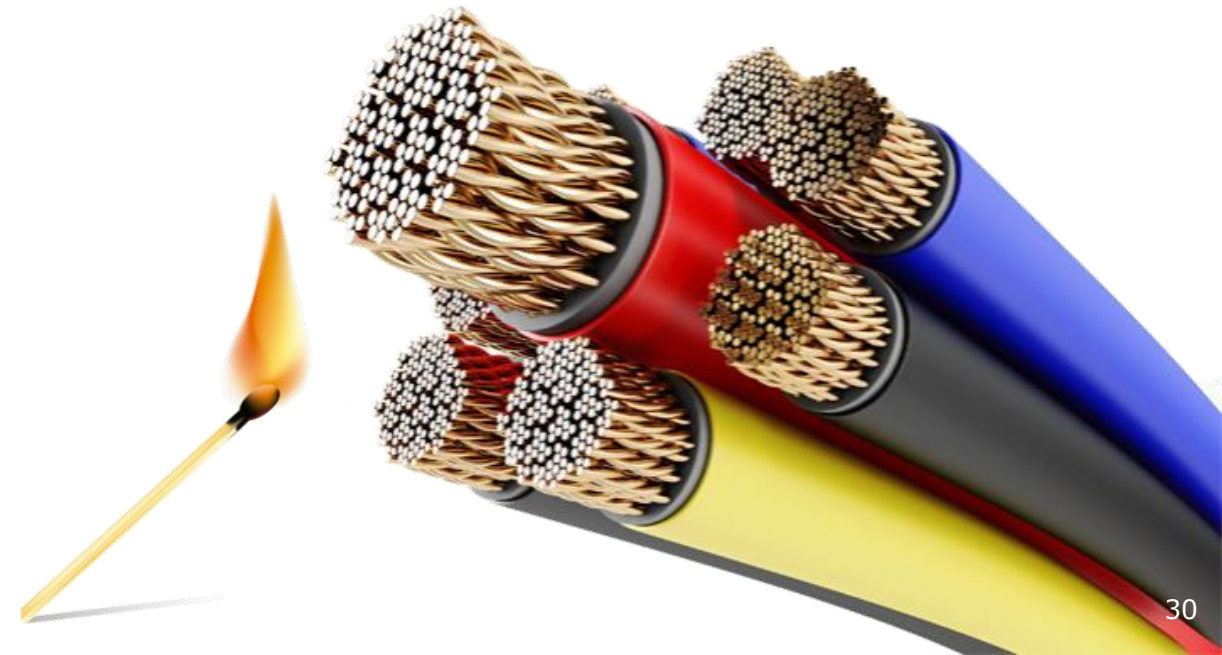
➤ **ADINS Clay – Halogen FR: Performance in Co PP**

Samples							UL-94 Rating 1.6 mm
PP Copolymer (%)	Decabromodiphenyl Ethane (%)	ADINS Clay 20 (%)	ATO (%)	Talc (%)	AOX (%)		
63.6	22	-	6	4	0.2	V-2	
63.3	22	4	3	4	0.2	V-0	

PP ISPLEN PB150 G2M MFI: 7 g/10min

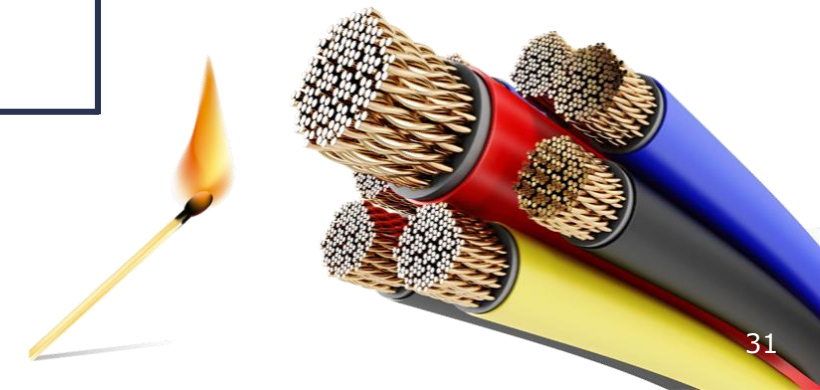
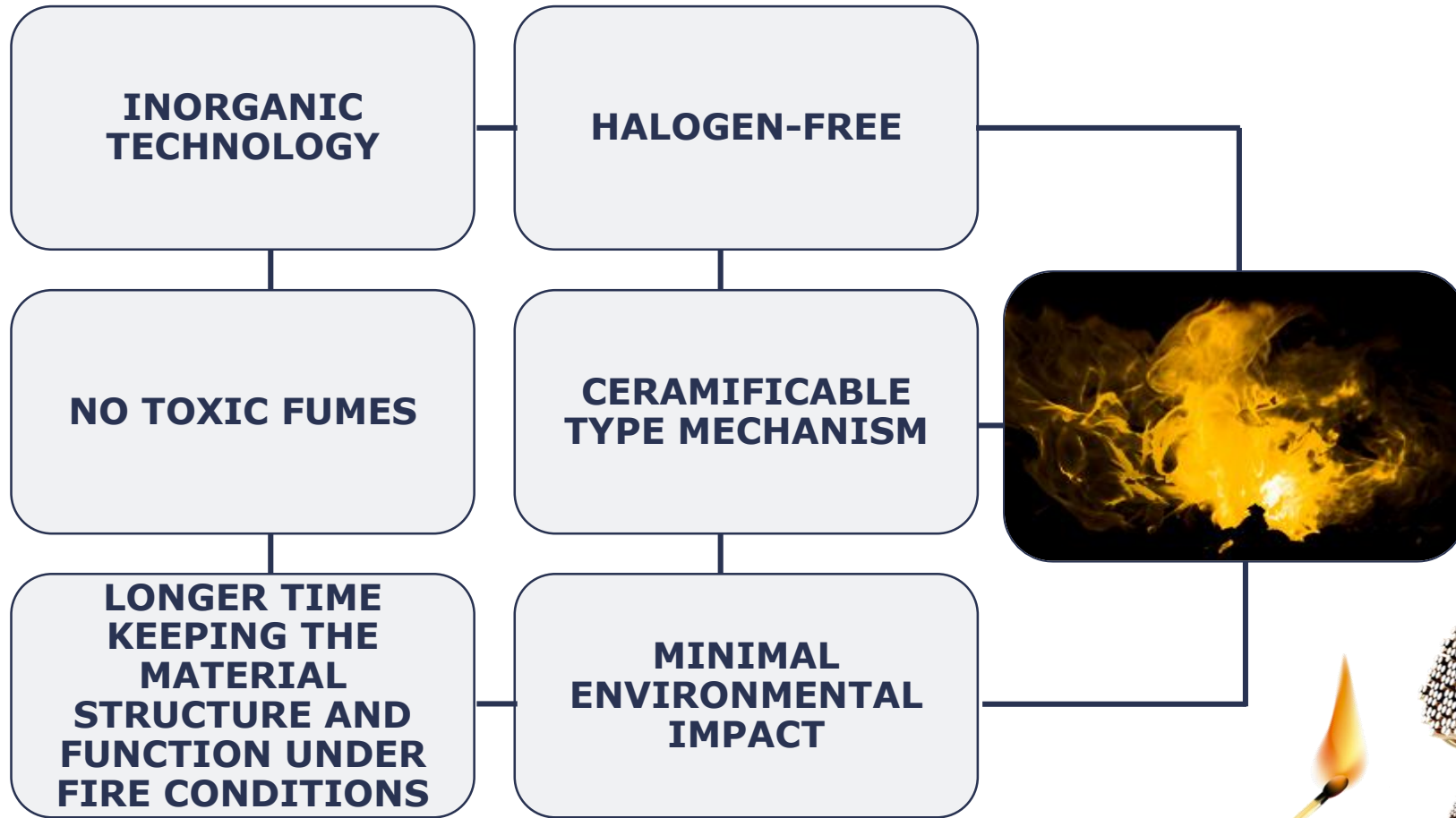
AOX: Antioxidant





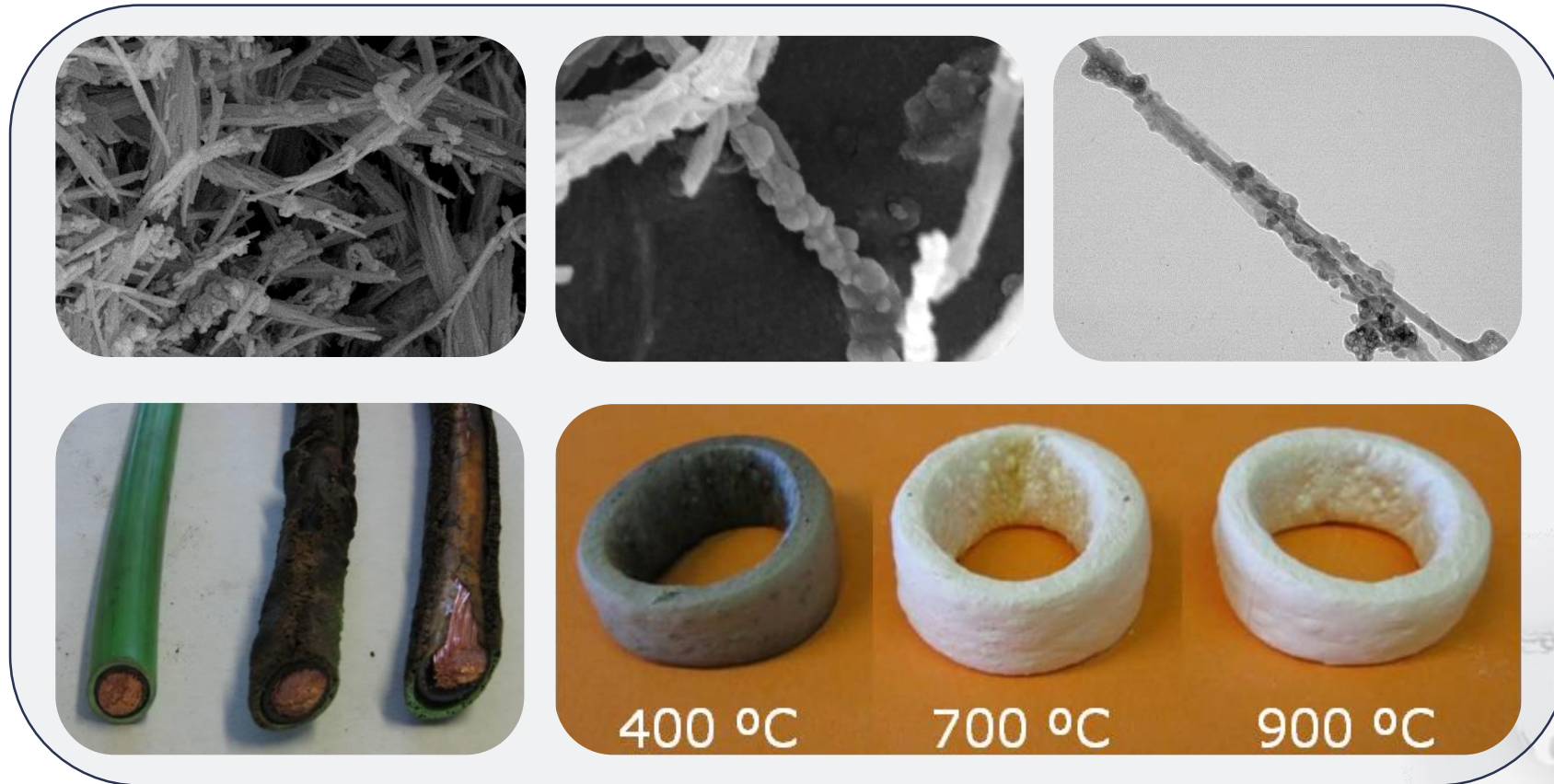


➤ **ADINS Fireproof – Smart Fireproofing**





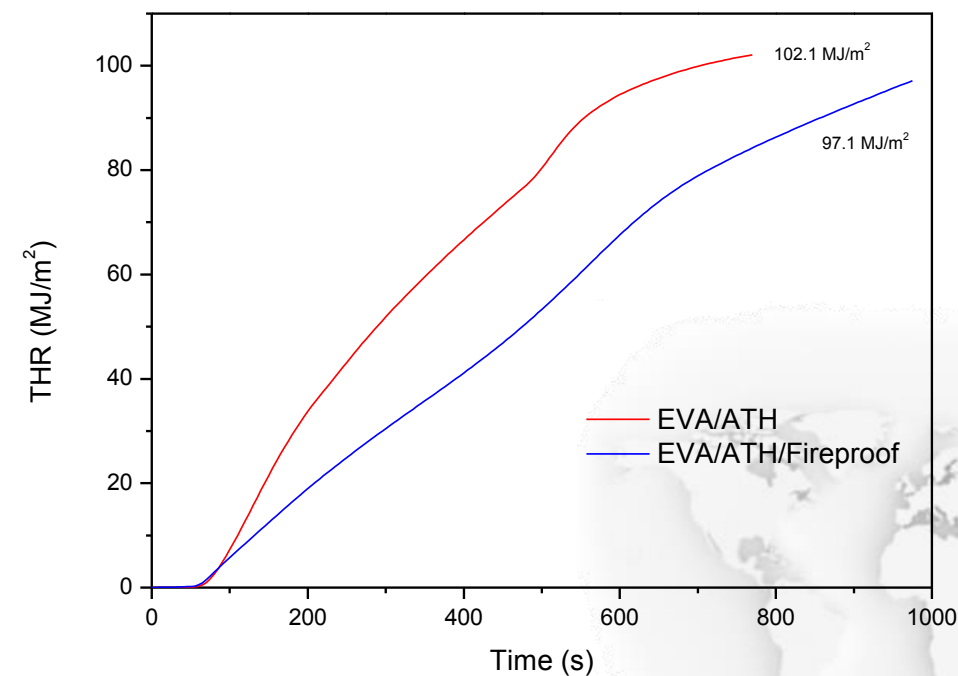
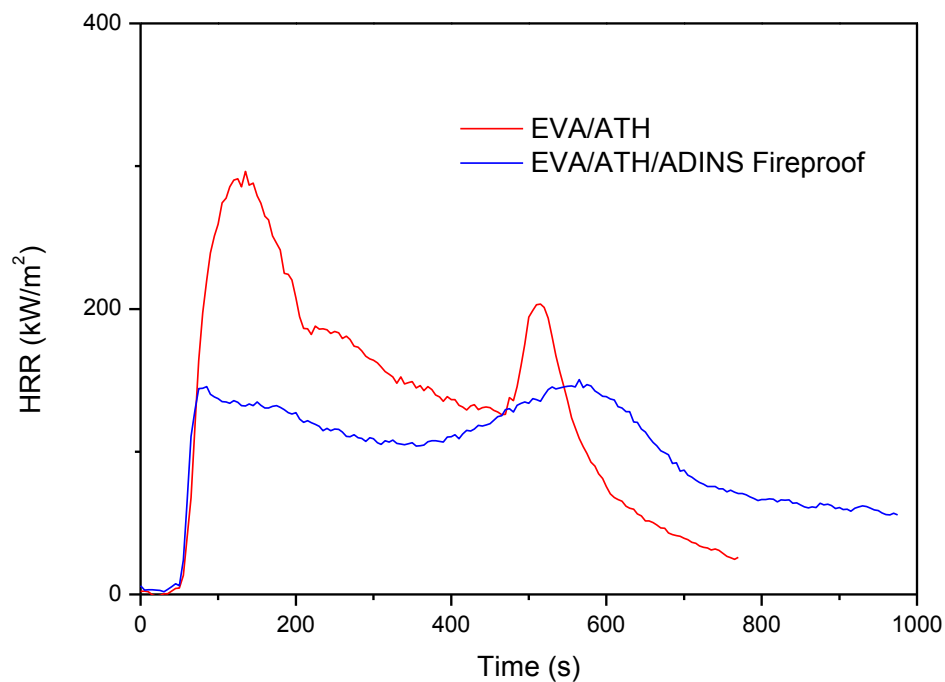
➤ ADINS Fireproof – Smart Fireproofing



TOLSA Special Additives

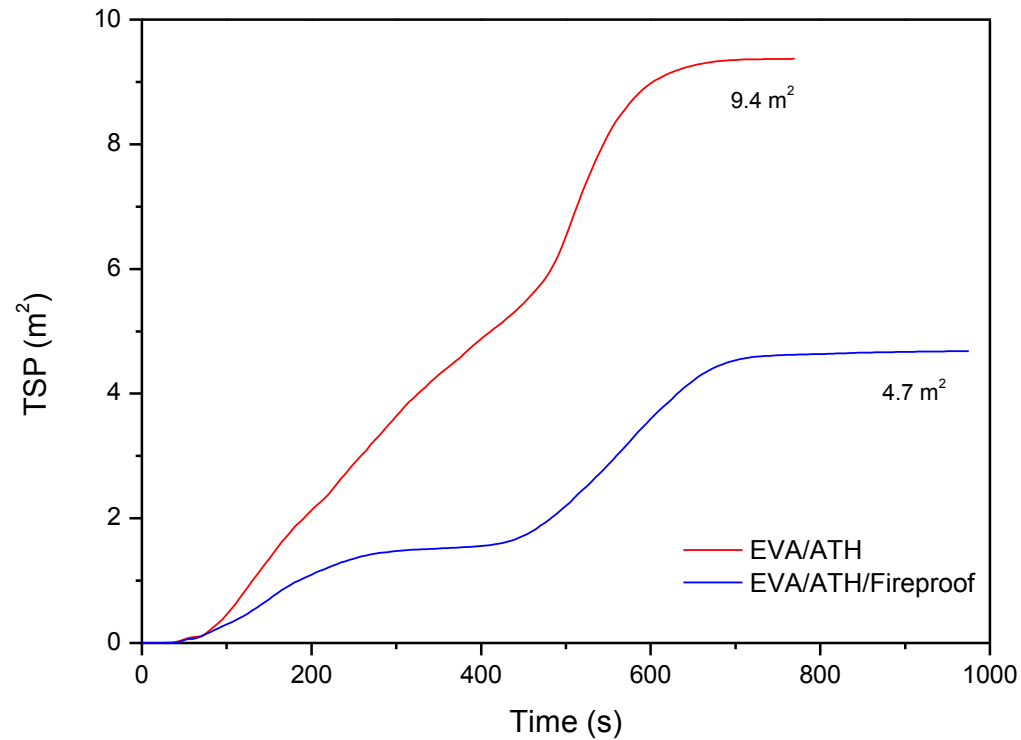


Material	EVA + ATH	EVA+ ATH + Fireproof
EVA	40	40
ATH (%)	60	47
ADINS Fireproof (%)	-----	13
LOI	25.0	30.0

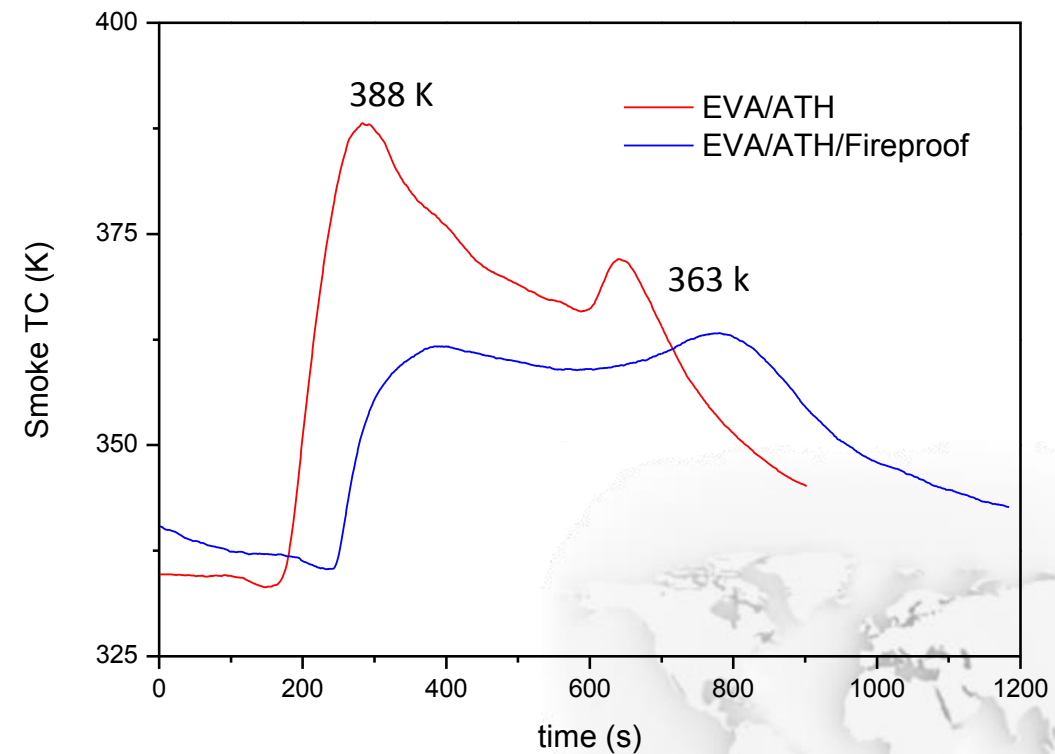




➤ ADINS Fireproof – Smart Fireproofing



Smoke Temperature



TOLSA Special Additives



ADINS Clay and Fireproof additives act as a synergistic additive with different flame retardants (i.e. Halogens, ATH, MDH, intumescent):

- **ADINS Clay**, organically modified sepiolites, enhances the performance of fire retardants:
 - Halogen FR: improve the efficiency of the flame retardant in standard formulations, reducing the FR content
 - Metal hydroxide: allow to reduce the FR content improving processability and mechanical properties.
 - Intumescent: improve the efficiency of the flame retardant and mechanical properties of the char layer.
- **ADINS Clay** reduces the fumes formation and helps the dispersion of flame retardants in the polymer.
- **ADINS Fireproof** is used to obtain a ceramifiable char layer in polymer systems with flame retardant in fire conditions:
 - Contributes to reduce the heat release and dripping and, as a consequence, the fire propagation.
 - Suitable for plastics and resins matrices with high requirements under fire conditions.



THANK YOU FOR YOUR ATTENTION



*Dentro de la tierra. Dentro de nuestras vidas.
Inside the earth. Withing our lives.*

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