NATIONAL TECHNICAL UNIVERSITY OF ATHENS
SCHOOL OF CHEMICAL ENGINEERING
Laboratory of Polymer Technology

FRPM21
European Meeting on
Fire Retardant
Polymeric Materials
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Budapest, Hungary

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Polypropylene compounds for Halogen Free Low Smoke (HFLS) Conduits

Budapest, Hungary - Monday, August 30, 2021 - Poster Session 1

Regulation drives FR development: Building security and fire protection

1987, London, UK

1996, Düsseldorf, Germany

1999, Mont Blanc, France

2003, Daegu, S. Korea

Strict Regulations for Fire Protection

Construction Product Regulation

Halogen-free low smoke (HFLS) cables in various types of buildings

Conduits: Cable protection pipes

FUVPP

Fire and UV Protected Polypropylene Pipes

- Develop flame retarded PP of low environmental impact and high resistance to ageing and exploit to produce novel piping systems for cables protection in superfluous installations
- New materials will be used in a totally new and patented production process that allows producing double layer corrugated PP conduits of very low external diameters (16-32 mm).

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European Union
European Regional Development Fund

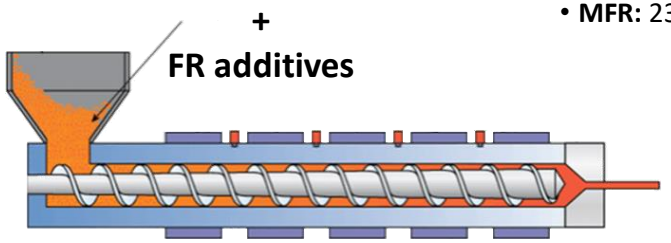
EPAnEK 2014–2020
OPERATIONAL PROGRAMME
COMPETITIVENESS
ENTREPRENEURSHIP
INNOVATION

ΕΣΠΑ 2014-2020
ανάπτυξη - εργασία - αλληλεγγύη
Partnership Agreement 2014 - 2020

Co-financed by Greece and the European Union

FUVPP: Develop flame retardant polypropylene (FR-PP) formulations for cable conduits

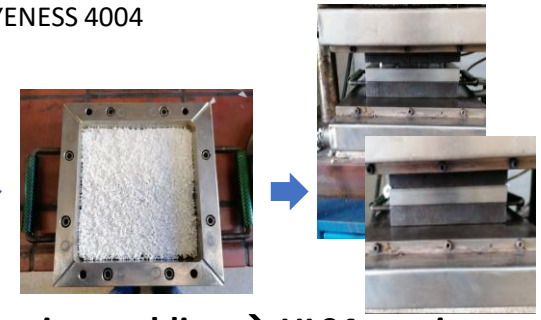
PP (Repsol ISPLEN PB131N5E)
+
FR additives



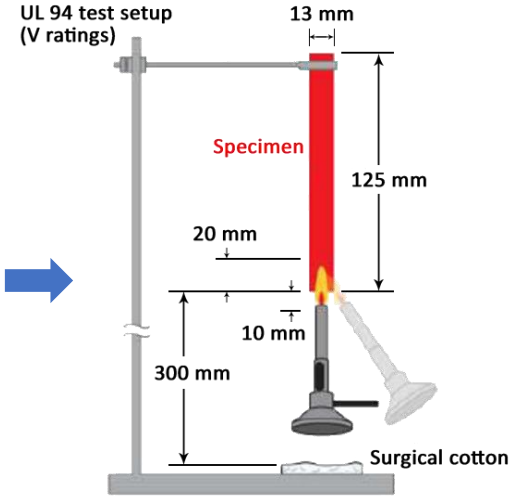
Twin-screw extrusion
(HAAKE Thermo Fischer PTW16, L/D = 25, 190-220 °C, 80 rpm)

FR compounds (FR1-FR3)

Characterization
- **TGA:** 30-800 °C (10°C/min), Mettler Toledo TGA/DSC1 HT
- **DSC:** 30-210 °C (10°C/min), Mettler Toledo DSC700, 2nd heating
- **MFR:** 230°C, 2.16 kg, Dynisco KAYENESS 4004



Compression molding → UL94 specimens (125x13x1.6mm)
(210 °C, 200 bar, 15 min)



UL94V Test
(ASTM D3801)

Formulations	Triazine [wt%]	APP [wt%]	Low halogen additive [wt%]	FR load [wt%]
PP	-	-	-	-
FR1 (1:3)	6.25	18.75	-	25
FR2 (1:4)	5	20	-	25
FR3	-	-	2	2

PP: REPSOL ISPLEN PB131N5E. Heterophasic co-polymer (iPP), superior impact strength
Triazine: Triazine-morpholine-piperazine derivative, Char forming agent CFA, (MCA Technologies)
APP: Ammonium polyphosphate, Acid source, (Clariant)
Low halogen additive: Aluminum hypophosphite (AHP), phosphorous-bromine salt and a dripping meltable synergic (Italmatch Chemicals)

FR1,2 mechanism: Intumescence

FR3 mechanism: Gas phase

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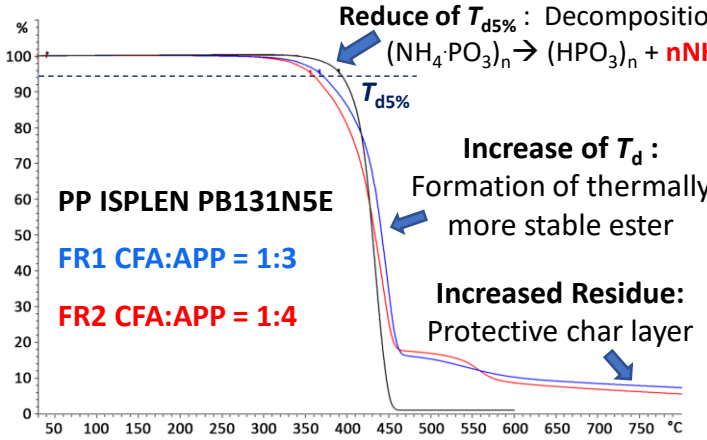
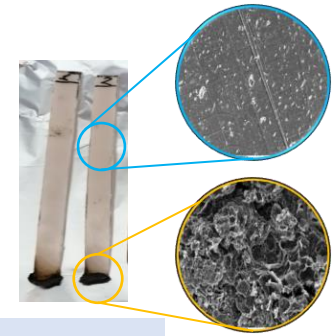
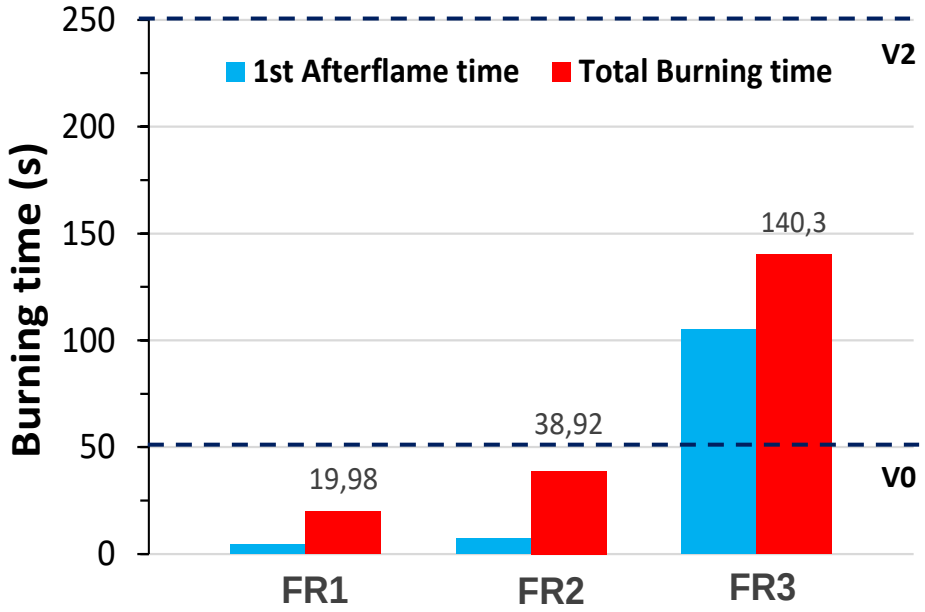
FUVPP: Develop flame retardant polypropylene (FR-PP) formulations for cable conduits

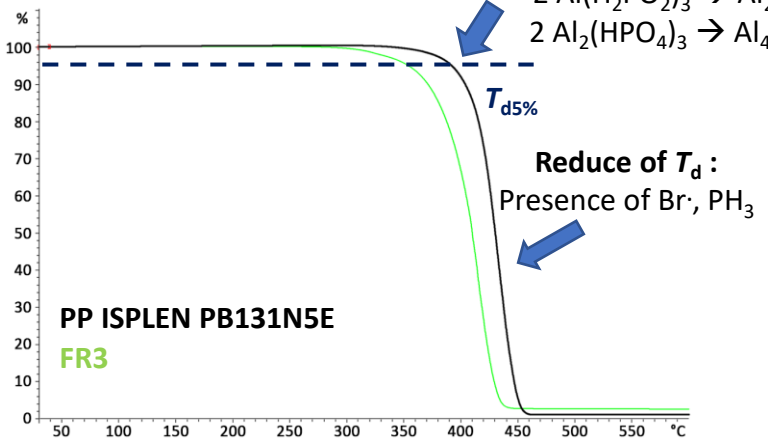
	UL94V Class	T_m [°C]	X_c [%]	$T_{d5\%}$ [°C]	T_d [°C]	MFR [g/10 min]
PP	NC	167.0 ± 0.2	27.8 ± 2.5	391.7 ± 0.1	433.5 ± 1.2	1.31 ± 0.01
FR1	V0	170.5 ± 0.5	21.5 ± 3.9	371.8 ± 3.9	447.3 ± 1.3	0.95 ± 0.01
FR2	V0	170.0 ± 0.6	28.3 ± 3.2	360.4 ± 3.2	444.6 ± 2.0	0.93 ± 0.01
FR3	V2	172.0 ± 0.8	25.7 ± 0.3	348.2 ± 7.0	413.7 ± 6.1	3.63 ± 0.40

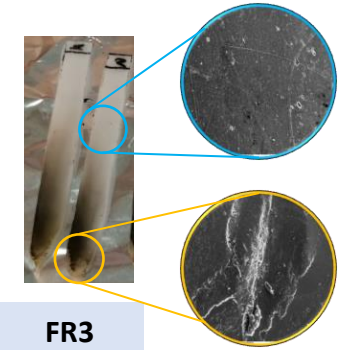




FR1, FR2
2x5V0







FR3
2x5V2

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