EVA Modification, Wire Coating

Flexibility, Elongation and Scratch Resistance

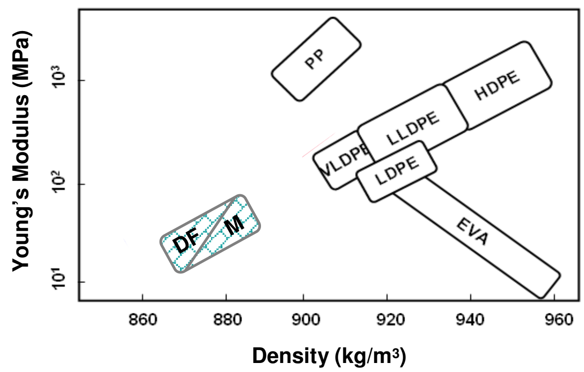
TAFMER™ DF & M

Ethylene based α-olefin copolymers

TAFMER™ DF & M is used as a modifier of Ethylene Vinyl Acetate (EVA), Polyethylene (PE) and other thermoplastics to improve its properties. It is suitable as both modifier and base resin in ethylene based Halogen Free Flame Retardant (HFFR) wire and cable jacket.

General characteristics attributed to TAFMER™ DF & M :

- Low Crystallinity and Density
  for high filler containability
- Low Young's Modulus
  for Softness and Flexibility
- Excellent Elongation
- Grafted polar group
  for Scratch resistance



Properties such as elongation, flexibility, low temperature impact resistance and scratch resistance are improved. Heat resistance can be reinforced by crosslinking.

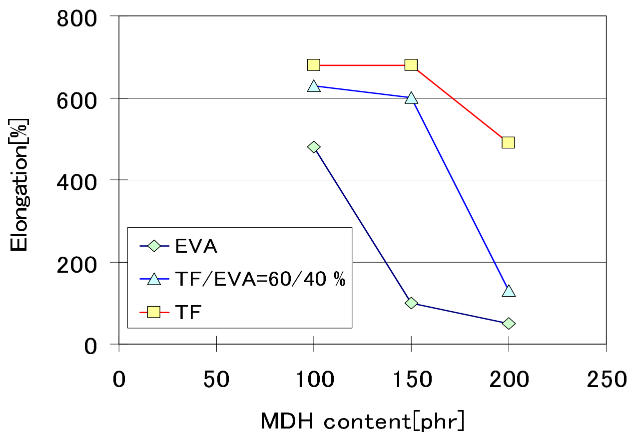
TAFMER™ DF in Ethylene Based Wire and Cable

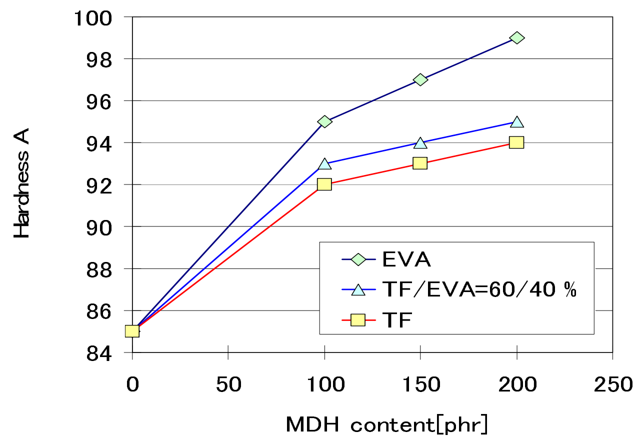
EVA is commonly used as base resin in ethylene based HFFR compound. However, properties such as elongation, softness and low temperature impact resistance become poor with higher loads of Magnesium Dihydrate (MDH) flame retardant:

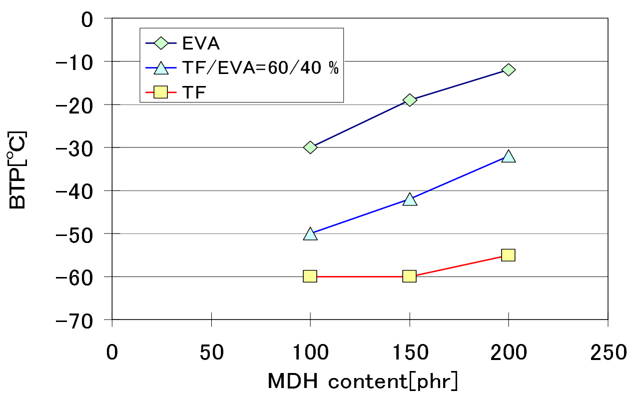
	Units	EVA		
Resin	%	100	100	100
MDH (Silane Treated)	phr	100	150	200
MFR (190 ℃, 10kg)	g/10min	10.0	4.2	2.2
Tensile Strength	MPa	8	11	12
Elongation at Break	%	480	100	30
Surface Hardness (Shore D)	–	43	50	53
Brittleness Temperature	℃	−30	−19	−12

EVA - VA content: 25 %、MFR(190 ℃), 2.16 kg= 2.0 g/10min
Hardness of EVA – 85 (shore A)

In comparison to EVA, TAFMER™ DF maintain the physical properties of the system with increasing MDH loads. Thus properties such as elongation, flexibility and low temperature impact resistance can be improved by modifying EVA with TAFMER™ DF.

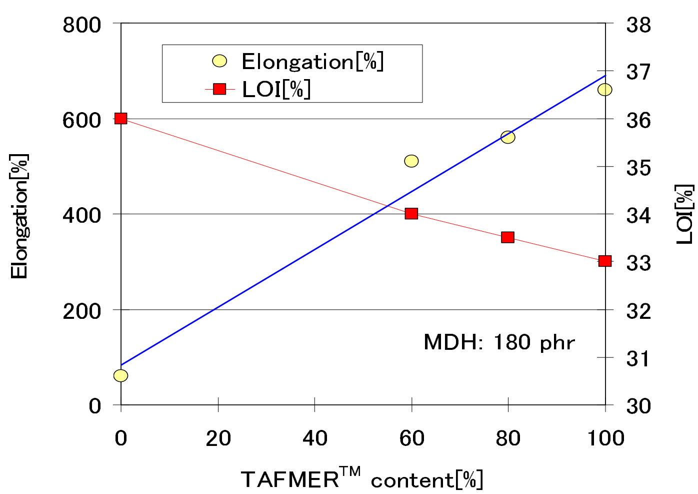






TF : TAFMER™ DF810
MFR(190 ℃) = 1.2 g/10min, Density = 885 kg/m^3
Hardness: 85 (Shore A)

LOI and elongation balance can be optimized by blend ratio of TAFMER™ into EVA.



TAFMER™ DF as Base Resin

TAFMER™ DF as itself is not a heat resistant material, however, its heat resistance can be improved by various methods of crosslinking.

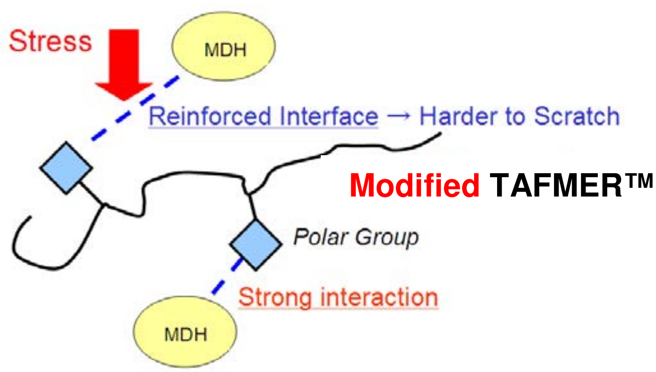
Difference of pre-treatment of flame retardants significantly affects on bending resistance of TAFMER™ DF based HFFR compound.
TAFMER™ M, with its polar group, functions as an optimizer of bending resistance.

TAFMER™ M

Modified ethylene based α-olefin copolymer

Grafted with polar group, TAFMER™ M does not only interact with metal hydrate, but is also compatible to Polyolefin Elastomer (POE).

In ethylene based wire and cables, TAFMER™ M is used to improve scratch resistance and whitening on bending.



TAFMER™ M improves interaction between MDH and POE. It result in better scratch and whitening on bending resistance.

		A	B	①	②
TAFMER™ DF	DF810 (%)	100	100	98	95
TAFMER™ M	MA8510 (%)	–	–	2	5
MDH (Fatty Acid Treated)	phr	100	170	100	170
MFR(190 ℃, 10 kg)	g/10min	8.0	3.6	5.6	2.5
Tensile Strength	MPa	16	7	16	7
Elongation	%	680	680	720	750
Martens Scratch Hardness	20g/mm	9.3	8.8	13.1	12.3
Scratch Resistance	Appearance after scratch	Poor	Poor	Good	Good
Whitening on Bending	Appearance	Poor	Poor	Good	Good

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Summary

TAFMER™ DF

- ☑ Improves softness and flexibility
- ☑ Improves elongation
- ☑ Improves low temperature impact resistance

TAFMER™ M

- ☑ Improves scratch resistance and whitening on bending

Basic Properties

TAFMER™ DF

Physical Properties	Test Method	Unit	DF605	DF610	DF640	DF710	DF740	DF7350
MFR(190℃/2.16kg)	ASTM D1238	g/10min	0.5	1.2	3.6	1.2	3.6	35
MFR(230℃/2.16kg)	ASTM D1238	g/10min	0.9	2.2	6.7	2.2	6.7	65
Density	ASTM D1505	kg/m³	861	862	864	870	870	870
Mechanical Properties								
Tensile Strength at Break	ASTM D638	MPa	> 5	> 3	> 3	> 15	> 8	> 2
Elongation at Break	ASTM D638	%	> 1000	> 1000	> 1000	> 1000	> 1000	> 1000
Torsional Rigidity	ASTM D1043	MPa	2	2	2	3	3	3
Surface Hardness (Shore A)	ASTM D2240	–	58	57	56	73	73	70
Thermal Properties								
Melting Point	MCI Method	℃	< 50	< 50	< 50	55	55	55
Brittleness Temperature	ASTM D746	℃	< -70	< -70	< -70	< -70	< -70	< -70

Physical Properties	Test Method	Unit	DF810	DF840	DF8200	DF940	DF110	DF140
MFR(190℃/2.16kg)	ASTM D1238	g/10min	1.2	3.6	18	3.6	1.2	3.6
MFR(230℃/2.16kg)	ASTM D1238	g/10min	2.2	6.7	34	6.7	2.2	6.7
Density	ASTM D1505	kg/m³	885	885	885	893	905	905
Mechanical Properties								
Tensile Strength at Break	ASTM D638	MPa	> 37	> 27	12	31	33	25
Elongation at Break	ASTM D638	%	> 1000	> 1000	950	900	750	750
Torsional Rigidity	ASTM D1043	MPa	9	9	9	12	25	25
Surface Hardness (Shore A)	ASTM D2240	–	87	86	85	92	95	945
Thermal Properties								
Melting Point	MCI Method	℃	66	66	66	77	94	93
Brittleness Temperature	ASTM D746	℃	< -70	< -70	< -70	< -70	< -70	< -70

Note: All of the above listed data are representative values, and not specific ones.

FDA

All the monomers and additives used in the above TAFMER™ grade are listed in the "Code of Federal Regulation, title 21 Food and Drugs, Parts 170 to 189" and "FCN (Food Contact Notification)".

EU Directive

All the monomers and additives used in the above TAFMER™ grade are listed in the EU Directive 2002/72/EC and its amendment 2008/39/EC.
The only additives with Specific Migration Limit (SML) are:
n-Octadecyl 3,5-di-t-butyl-4-hydroxy hydrocinnamate (CAS No.2082-79-3, Ref No.68320)
: SML= 6mg/kg

Please ensure that the SML and Overall Migration (OM) are within the specified value in the end-use products,.

TAFMER™ M

Physical Properties	Test Method	Unit	MA8510	MH7010	MH7020
MFR(190℃/2.16kg)	ASTM D1238	g/10min	2.4	0.9	0.7
MFR(230℃/2.16kg)	ASTM D1238	g/10min	5.0	1.8	1.5
Density	ASTM D1505	kg/m^3	885	870	873
Mechanical Properties					
Tensile Strength at Break	ASTM D638	MPa	> 24	> 8	> 8
Elongation at Break	ASTM D638	%	> 1000	> 1000	> 1000
Surface Hardness (Shore A)	ASTM D2240	—	85	70	70
Thermal Properties					
Brittleness Temperature	ASTM D746	℃	< -70	< -70	< -70

Note: All of the above listed data are representative values, and not specific ones.

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