DF series, mPPE (Junction boxes and Connectors)

Materials for Photovoltaic and Solar system





Introduction of DF-01

Hanwha DF-01 is modified polyphenylene ether (mPPE) material, which has a low water absorption rate and excellent hydrolytic stability. Due to the molecular structure of mPPE, it exhibits good mechanical strength and chemical resistance. DF-01 a suitable product for photovoltaic junction box.





DF-01 : Long term Thermal Properties

Hanwha DF-01 RTI (Relative Temperature Index) is 15°C higher than competing materials. It is125°C without imp and 120°C with imp. The DF-01, specialized for thermal stability, can be applied to new products that require a heat resistance of over 120°C, in addition to existing solar Junction box components.

Property	Hanwha DF-01	Company A	Company B	Component - Plastics Guide Information View Certificate of Compiliance Hanwha Compound Corporation 3, Samdong-ro, Yosu-si Joolianam-do 59816 KR DF-01 Polyphenylene Ether (m-PPE), modified, furnished as pellets Min. This Plane DI Line DI Line						E488329 RTI Str	
Flame retardancy	V0	V0	V0	Color ALL NC	(mm) 0.75 1.5 3.0 1.5 3.0	Class V-0 V-0 V-0 V-0, 5VB V-0, 5VB	<u>HWI</u> - - - -	HAI 0 0 0 0	(°C) 125 125 125 125 125 125	(°C) 120 120 120 120 120 120 120	(°C) 125 125 125 125 125 125
RTI Str/Elec	125	110	110	ні	Comparative Tracking Index (CTI): 2 Dielectric Strength (kV/mm): - High-Voltage Arc Tracking Rate (HVTR): - Dimensional Change (%): -			Inclined Plane Tracking (IPT) kV: - Volume Resistivity (10 ^x ohm-cm): - Surface Resistivity (10 ^x ohms/square): - High Volt, Low Current Arc Resis (D495): -			
RTI Imp	120	105	105	ANSI/UL 94 sm Report Date: 20 Last Revised: 20	ell-scale test data does not pert materials used in the c 25-02-28 25-02-28	in to building materials, furnist omponents and parts of end-pi	nings and related o roduct devices and	ontents ANSI/UL 5 d appliances, where 025 UL Solutions	4 small-scale test data is intr the acceptability of the comb s	anded solely for determining t bination is determined by UL.	ALSO CERTIFIED TO IEC REQUIREMENTS

* Str (Tensile strength), Elec (Dielectric strength), Imp (Impact strength)



DF-01 : Yellow Card

	Ъ. PDF								
Hanwha DF-01									
YellowCard									

Hanwha DF-01 Yellow card can be searched and verified at any time through UL's website. (https://www.ulprospector.com)

	tor®		Component - Plastics DF-01	Yellow Card [™]	
Dashboard Material Search v Yellow Card Search v Tools and Resources v A			Hanwha Compound Corporation 93, Samdong-ro Yeosu-si, Jeollanam-do 59616 Republic of Korea	File Number: E488329	
REFINEMENTS Yellow Card	23 Results : Company Name:"Hanwl	na Compound Ca	DF-01 Polyphenylene Ether (m-PPE), modified, pellets		LISO CERTIFIED TO IEC REQUIREMENTS
Search	Product	Compan	Flammability	Value	Test Method
Keyword	DF-01	Hanwha	Flame Rating 0.75 mm, ALL 1.5 mm, ALL	V-0 V-0	UL 94 IEC 60695-11-10, -20
Add * to your text to perform a partial match search. ex: nyl*	HANFRENE HFFR-1520	Hanwha	1.5 mm, NC 3.0 mm, ALL 3.0 mm, NC	V-0, 5VB V-0 V-0, 5VB	Test Mathed
Company Name	HFFR-1540	Hanwha	High Amp Arc Ignition (HAI)	value	UL 746A
Hanwha Compound Corporation ×	<u>HFTU-180 B</u>	Hanwha	0.75 mm 1.5 mm 3.0 mm	PLC 0 PLC 0 PLC 0	
✓ <u>Show filter options</u>	HFTV-180A BK	Hanwha	Comparative Tracking Index (CTI)	PLC 2	UL 746A
Tradename	HGE-131G30FR	Hanwha	Thermal RTI Elec 0.75 mm	Value	Test Method UL 746B
Click to view and filter values	HGE-131G30FR(f1)	Hanwha	1.5 mm	125 °C	
 <u>Show filter options</u> Category 	HGE-651G10HLW	Hanwha	3.0 mm RTI Imp 0.75 mm	125 °C	UL 746B
Click to view and filter values	HGE-651V10FR	Hanwha	1.5 mm 3.0 mm	120 °C 120 °C	
 <u>Show filter options</u> 	HGE-651V10LW	Hanwha	RTI Str		UL 746B
Minimum Thickness	HGE-915GM60DS	Hanwha	0.75 mm 1.5 mm 3.0 mm	125 °C 125 °C 125 °C	

Hanwha compound



DF-01 : Long term Thermal Properties

Hanwha DF-01 retentions excellent physical properties at high temperatures compared to competitors. In particular, the impact strength remains above 90% after more than 1,000 hr at 120°C, making it suitable for use in junction box for high-efficiency solar modules.



* RTI temperature refers to the temperature at which 50% of the physical properties are maintained after 100,000 hrs (approximately 11 years) of use.

DF-01 : Hydrolytic Stability

Hanwha DF series is a product that exhibits excellent hydrolysis resistance in high temperature and high humidity environments (85°C/85%). Under the same conditions, it maintains good impact strength compared to PC.



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Hanwha Compound



DF-01 : Reliability Results - Module

Hanwha Compound, DF-01 is mPPE based resin, well-suited for photovoltaic (PV) junction box. The DF-01 has high RTI temperature and good durability and weather resistance and flame retardance. DF-01 achieved superior performance results compared to other mPPE materials for junction boxes in solar module reliability assessment and IEC 61215 assessment. In addition to achieving a high RTI(125°C, long term heat resistance, UL94 V0), the Hanwha compound DF-01 provides superior impact strength and good weatherability performance. As the output of photovoltaic modules increases, the operating temperature of the junction box increase, placing greater emphasis on the heat resistance stability of materials

- Test method : IEC 61215
- Test List : Performance measurement, Thermal cycle, Humidity freeze, Damp heat, UV resistance, Cold conditioning, Dry heat, Materials creep, Dynamic mechanical load



[Qcells Test result]



[Reliability Test]



Introduction of DF-03

DF-03 is modified polyphenylene ether (mPPE) and has low moisture absorption characteristics equivalent to those of DF-01, along with excellent hydrolytic stability and chemical resistance. DF-03 material provides low-temperature impact strength, good weatherability and good dimensional stability. This new product also meets the UL94 V0 standard for flame retardance at 1.5mm and delivers long-term heat resistance.





Grade Line-up

Property		Condition	Unit	Stan	dard	High impact		
	Method			Hanwha DF-01	Company A	Hanwha DF-03	Company A	
Density	ASTM D792	-	-	1.10	1.10	1.09	1.09	
Tensile strength	ASTM D638	50mm/min	kgf/cm ²	700	690	550	550	
Tensile strain		50mm/min	%	12	12	20	18	
Flexural strength	ASTM D790	2.8mm/min	kgf/cm ²	1,100	1,070	900	860	
Flexural modulus		2.8mm/min	kgf/cm ²	25,500	25,000	21,000	20,000	
IZOD (notched)	ASTM D256	1/8″	kgf cm/cm	18.0	17.0	52.0	52.0	
HDT	ASTM D648	18.56kgf/cm ² 6.4mm	°C	120	115	107	106	
RTI W/O Imp			0.75mm	°C	125	110	105 (expect)	105
RTI with Imp	UL /40B	0.7 Smm	C	120	105	105 (expect)	105	
Flame retardancy	UL94	0.75mm	-	V0	VO	V0	VO	
2025년 4월 Hanwha compound 9								



