The born of **HFFR TPE** –

The Perfect Replacement of PVC cable

Halogen–free replacement of PVC-based insulation and jacketing materials is a continuing industry trend driven by the green and sustainability concerns, particularly in the personal electronics and appliance market.

Recently, brand owners have been aggressively looking to replace PVC with halogen free flame retardant (HFFR) compound for various wiring applications such as computers, cell phones, and other portable devices. Specifically, the HFFR material will be used as part of assemblies for power cords, data cables including USB/mouse cord, and connectors, etc. The newly developed HFFR compounds are to address the market needs and must comply with their relevant regional standards in which the device will be sold. For example, for the North American market, the cable must meet **UL-62**. **HD21.14** is critical for the European Community and **JCS 4509** for the Japanese market.

In order to meet the performance levels of today's cables, the newly developed HFFR compounds need to deliver beyond the specifications. To meet the demanding requirements from cable makers and end-users, the material must have excellent combustion properties (meet **VW-1** for all cables), excellent flexibility (similar to PVC), good surface touch and hand feeling, good chemical resistance, etc. Besides they must meet the needs of various basic requirements such as heat deformation for UL62, low smoke density for HD21.14 and specific requirement for JCS 4509 as well.

For data cable and connectors, the jacketing material needs to present excellent appearance, surface smoothness and the ability to pass the environment test without migration. The strain relief material will also need to be designed to provide excellent bending performance and meet the customers' needs.

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Why choose our HFFR cable compound?

1. **Excellent Physical and Mechanical Properties**

   Tensile strength > 13MPa (13MPa – 32MPa)
   Elongation at break > 300%

2. **Excellent Flame Retardancy**

   Pass VW-1 easily without dripping

3. **Easy to Process**

   Standard extruder without modification can be used

4. **Low Density**

   HFFR-TPE : from 1.05 to 1.09
   HFFR-TPU : around 1.25
   → provide excellent price efficiency for your final product

Suitable for AC power cords or DC/Data cable

1. **HFFR- TPU :**
   mainly for producing power cord, phone wire, USB connector cable, and wiring for computer and peripheral equipment
2. **HFFR- TPE :**
   designed for wind power cable, power cord, phone wire, USB connector cable, wiring for computer and peripheral equipment. It is characterized by flexibility at lower temperature, excellent physical performances and easy to process.
3. **HFFR- TPE (injection grade) :**
   designed for molding of all type plugs with requirement of flexibility and V-0 (3.2mm) flame retardancy. It is suitable for molding of strain relief parts where a softer material is required.

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Performance Requirements of Jacketing and Insulation Cables for Major Market Standards

Market	U.S.	Europe	Japan
Specification	**UL62**	**HD21.14**	**JCS4509**
1. Tensile Strength(MPa)	> 8.3	> 7.5	> 8
2. Elongation at break	> 200%	> 150 %	> 200 %
3. Heat Aging Condition	121°C@ 168 hrs	80°C@ 168 hrs	90°C @ 96 hrs
Aged Tensile Strength Retention	> 75 %	80 – 120%	> 80%
Aged Tensile Elongation Retention	> 75 %	80 – 120%	> 80%
4. Flame Retardancy	VW-1 (UL1581)	VW-1 (IEC60332)	Pass (JISC3005-4.26)
5. Heat Deformation	< 50%	< 50%	< 10%
Testing Condition	150°C@ 1 hr	80°C@ 4 hrs	75°C@ 96 hrs
6. Dielectric Strength	Pass	N/A	Pass
Testing Condition	1.5kV, 1 min	N/A	1kV in water, 2kV in air, 5kV spark
7. Cold Bend	No crack	No crack	No crack
Testing Condition	-20°C@ 4 hrs	-15°C@ 4 hrs	-15°C@ 1 hr
8. Heat Shock`	Pass	N/A	N/A
Testing Condition	150°C@ 1 hr	N/A	N/A
9. Water Immersion Test	N/A	TS Change <30% TE change <35%	N/A
Testing Condition	N/A	70°C@ 168 hrs	N/A

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General Requirements of Jacketing Material for Major Market Standard

Market	Puro	Puro	U.S.	Europe	Japan
Requirement	**HFFR-TPU**	**HFFR-TPE**	**UL62**	**HD21.14**	**JCS4509**
Tensile Strength	32 MPa	13 MPa	> 8.3 MPa	> 7.5 MPa	> 8 MPa
Elongation at break	450%	380%-460%	> 200%	> 150 %	> 200 %
Aged Tensile Strength Retention	90%	98%-110%	> 75 %	80 – 120%	> 80%
Aged Tensile Elongation Retention	107%	84%-95%	> 75 %	80 – 120%	> 80%
Flame Retardancy	VW-1	VW-1	VW-1 (UL1581)	VW-1 (IEC60332)	Pass (JISC3005-4.26)
Heat Deformation	~ 5%	8%-39%	< 50%	< 50%	< 10%
Dielectric Strength	Pass	Pass	Pass	N/A	Pass
Cold Bend	No Crack	No Crack	No crack	No crack	No crack
Heat Shock`	Pass	Pass	Pass	N/A	N/A
Water Immersion Test	Pass	Pass	N/A	TS Change <30% TE change <35%	N/A

Generally, the testing of **DC cable** includes other tests:-

1. **Electrical resistance test**: insulation resistance, conductor resistance, withstand voltage, etc
2. **Reliability test**: VW-1 flame test, heat deformation test, cold bend, heat shock, etc
3. **Bending test**: The cable is bent with a bending machine, in general, with an angle of ±90°, a cycling rate of 30 cycle per minute, a roller radius of 30mm and a load of 120g. Typically it requires more than 5000 cycles for the cable before breaking.
4. **Non-migration test**: The test will be performed in a humidity oven, in general, under 80°C and 80 humidity for 1 week. After the test is completed, the cable will be taken out and checked the ABS or PC/ABS plaque that any liquid migrated out and left a mark on the plaque which cannot be removed by water or ethanol.

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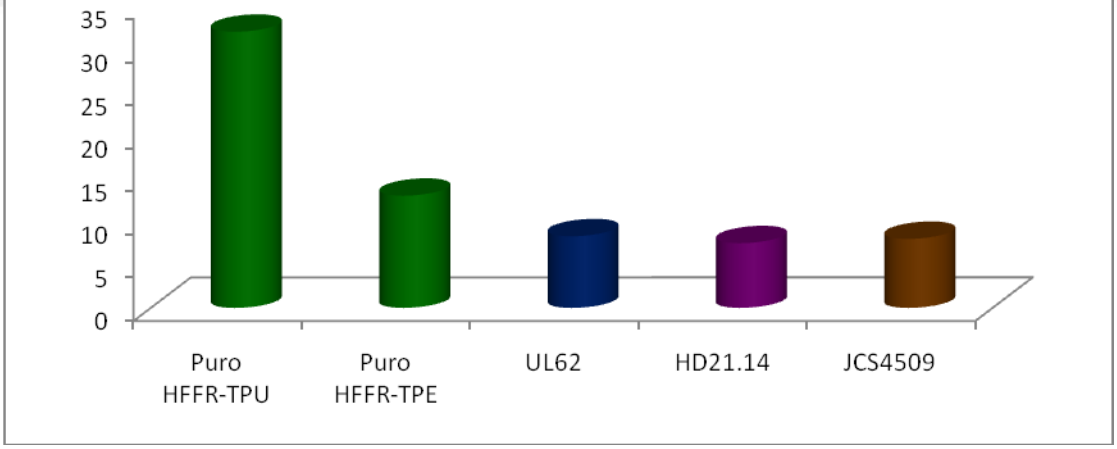
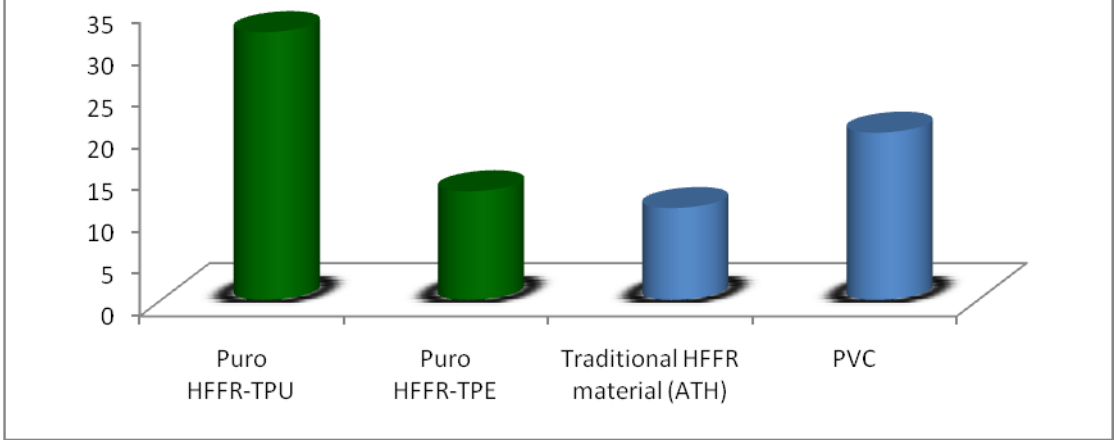
Tensile Strength (MPa)
Comparison with the General Standards



Tensile Stregnth (MPa)
Comparision with Different materials



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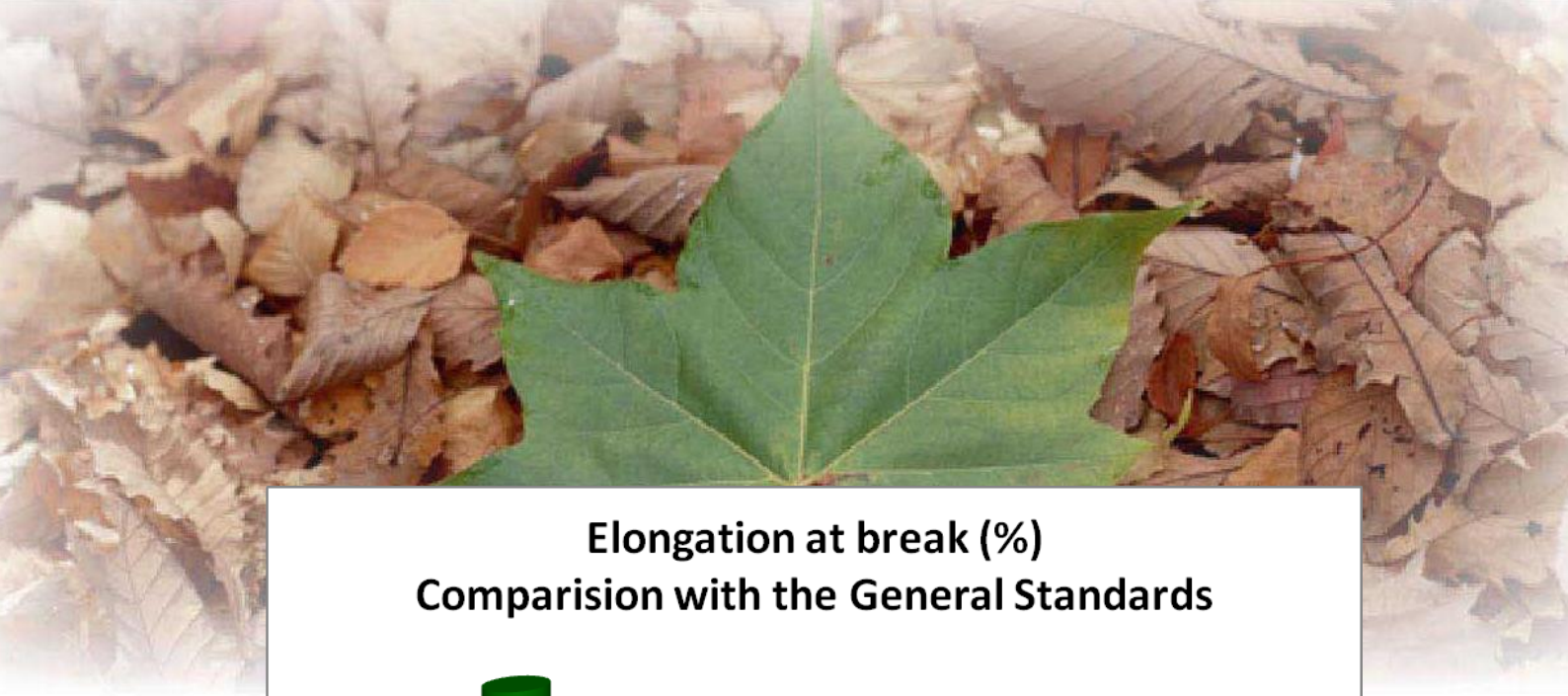

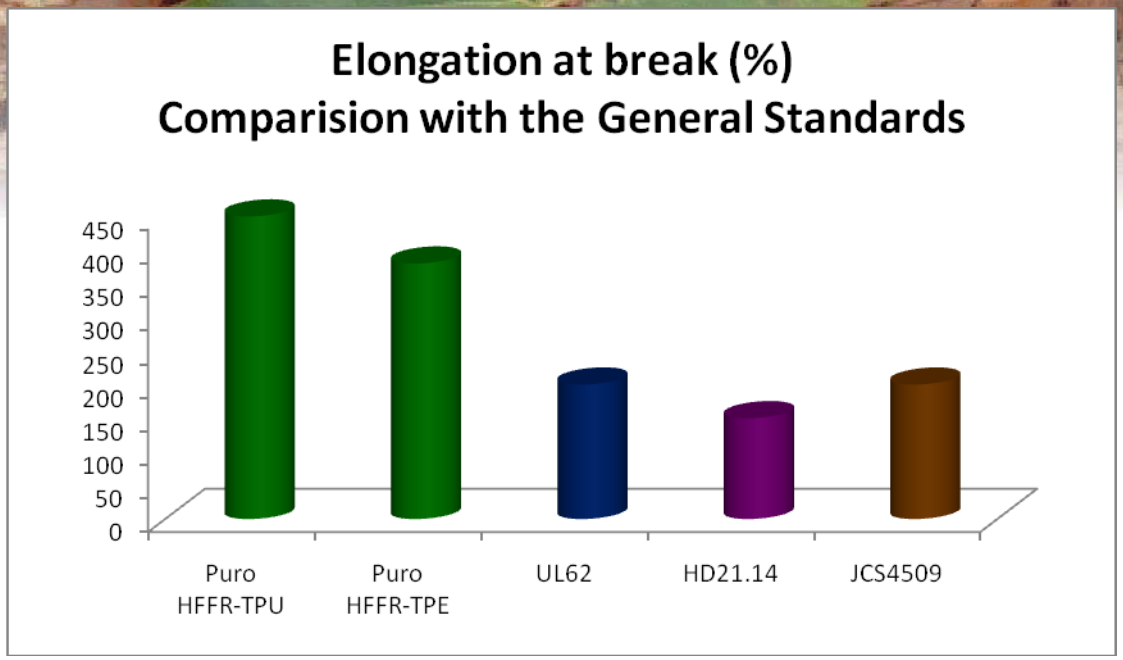

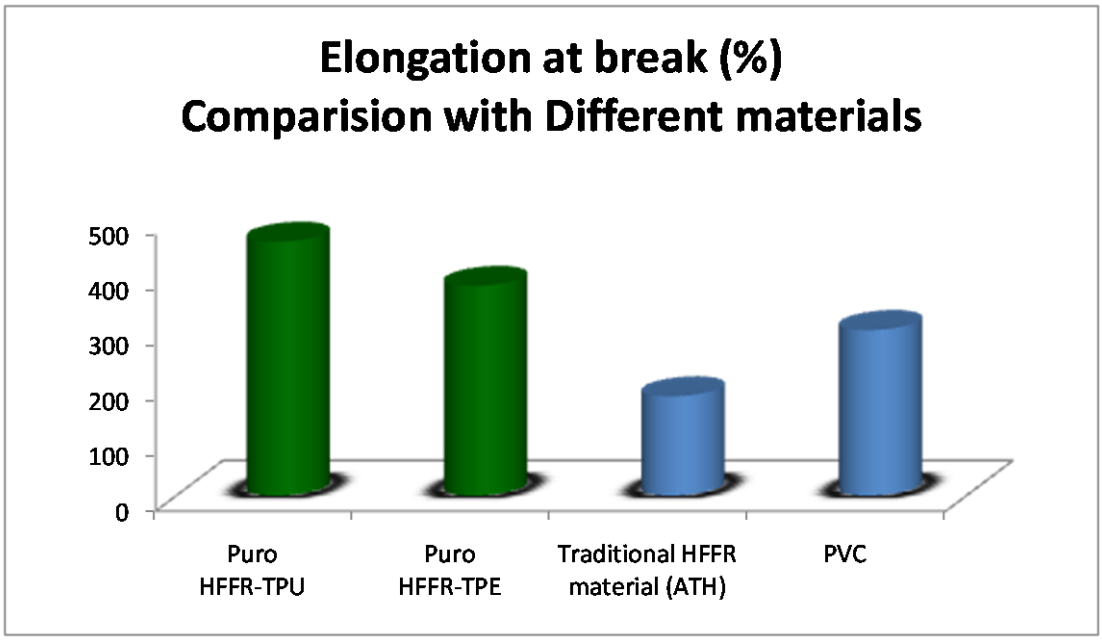

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