
# ForTii® T11

## Superior thermal shock resistance and CTI >800V for automotive electronics

With the move towards electrification the automotive industry is going through a radical change. Electric powertrains typically operate at high voltages, with currents of several hundred amperes. Therefore, safety and reliability have never been as important as they are today. The industry has placed stringent safety regulations on electronic components to ensure they are safe, tough, durable, flame retardant, electrically insulated, and able to accommodate high-flow processing to mold thin-walled components.

The polymers used to manufacture parts need to achieve a high comparative tracking index (CTI), to prevent electrical tracking that could cause burning, smouldering or fire. The materials used to encase electronics must demonstrate superior electrical insulation to safely contain the high voltages and data transmission rates required for increasingly complex applications. Materials must also withstand warpage, fatigue, and failure due to the elevated temperatures, and the potential for thermal shock caused by fluctuating temperatures over long periods of time. Manufacturers also need materials that can create strong weldlines to prevent premature cracking, and that resist moisture uptake to avoid blistering.

DSM's ForTii® T11 is a durable, high-strength material used for surface mount technology (SMT) connectors, cooling fan brackets, and high voltage connectors in automotive electrical systems.

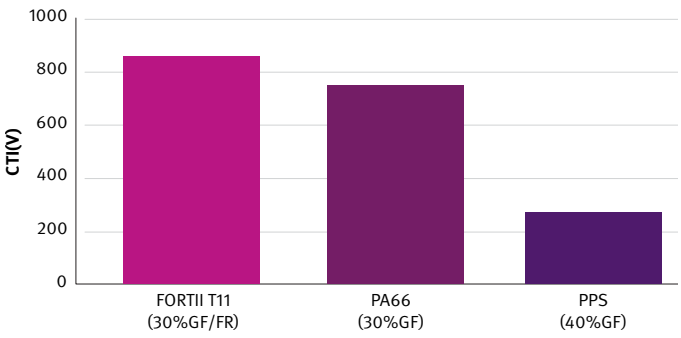
Engineered for best-in-class blistering resistance and good processing capabilities, the material also demonstrates:

- CTI >800V and PLC 0 easily adapted for fine pitch and miniature design
- Robust JEDEC MSL 2 classification for reflow soldering (up to MSL 1 in wall thicknesses less than 0.8mm)
- High heat resistance for USCAR Class 4 applications
- High RTI rating of 140°C at 0.35mm
- UL 94 rating of V-0 at 0.2mm
- Low CLTE for enhanced part performance

### Highest comparative tracking index (CTI) >800V

ForTii T11 is the industry's only material with a CTI above 800V after 1,000 hours of heat aging at 120°C. ForTii T11 has a confirmed CTI rating above 800V. This adds additional safety margin over the industry standard high CTI rating of 600V. It provides the freedom to manufacture designs with thinner walls and shorter creepage distances.

**Comparative Tracking Index (CTI) of various polymers**

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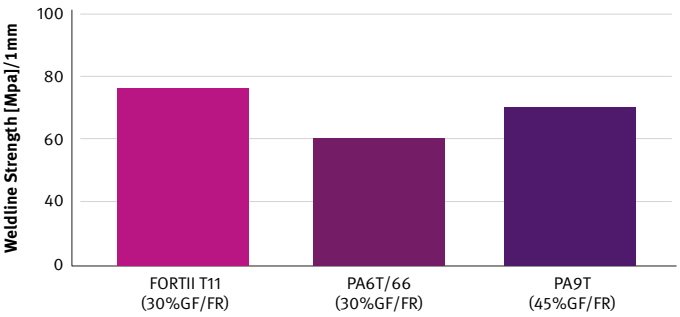
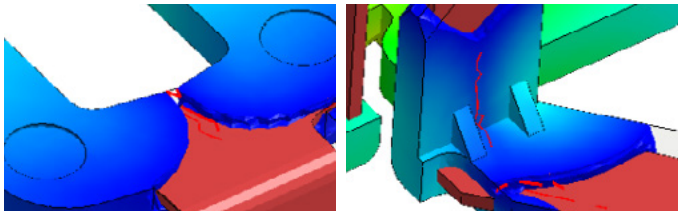
## Superior weldline strength

Parts made from ForTii T11 demonstrate superior strength at weldlines, even in thin-walled designs—outperforming competitive materials. The material provides greater design flexibility by minimizing the risk of mechanical failure in wall thickness of 1mm or less.

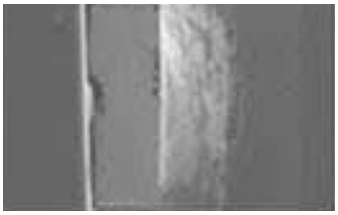



**ForTii T11 demonstrates superior weldline strength**



**Competitive PPA**

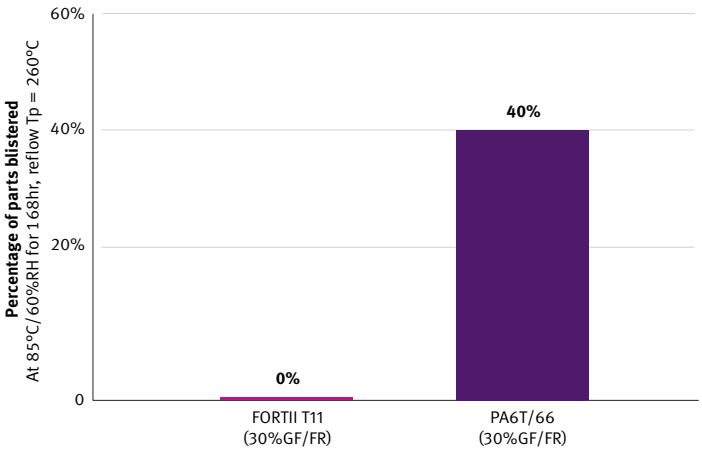
**DSM PPA (ForTii T11 30%GF/FR)**



## Fully resistant to blistering for reflow soldering process

ForTii T11 parts are unaffected by continuous exposure to high moisture levels over a period of 168 hours, compared to PA6T/66, which experienced blistering on 40% of parts.

**Blistering Performance of PPA Materials — JEDEC MSL 2**

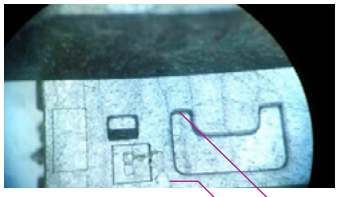



## Advanced strength under stress

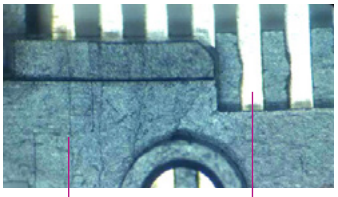
ForTii T11 connectors demonstrate resistance to mechanical failure after multiple thermal shock cycles, outperforming competitive materials.

| Test Parts | Mating | Temperature Cycle | Vibration |
|---|---|---|---|
| Reflow header | 30 cycles | -55~105°C (D:1.5hrs) | 10~55Hz/S.A. 0.75mm, 10 cycles, 3 axis |

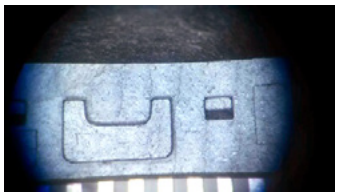
**PA6T/66 (30%GF/FR)**



**PA9T (45%GF/FR)**




**ForTii T11 (30%GF/FR)**



## About the technology

DSM's ForTii T11 is a glass-reinforced semi-aromatic polymer based on our unique C4 technology, offering optimal strength, durability and stiffness for manufacturing automotive electronics with best-in-class safety performance.

## ForTii T11 Properties

**Tensile Modulus** | 12,000MPa
**Stress at Break** | 160MPa
**Strain at break** | 2.1%
**CTI** | >800V
**Burning Behavior @ 0.2mm** | V-0
**RTI** | 140°C at 0.35mm