ForTii® and **Arnite**®RFLX in reflective LED applications

Significant improvements in LED performance and cost have caused LED technology to begin rapidly replacing conventional lighting solutions such as incandescent and fluorescent lighting. LED lighting is substantially different from conventional solutions, with smaller light sources, the need to be cooled, emission of a different spectrum of light, and a lifetime up to 50 times longer.

To make the best use of all the benefits of LED, DSM has created new highly reflective materials that are developed specifically for this new technology. The materials used typically require a bright white color in order to reflect light or to match the appearance of the application. Yet light output from LED lamps and luminaries degrades over time. Next to the degradation of the LED and the driver electronics this is caused by the degradation of the optical system, specifically discoloration of the reflector. Also during the production process of the LED solution polymer discoloration needs to be avoided. For instance soldering can also cause severe discoloration of white plastics.

LED array holders: ForTii®

DSM developed a new white grade of ForTii® (F11CW), specially formulated for the challenging requirements of an LED array holder. The shallow ring connects the LED array to all the interfaces – mechanical, electrical, thermal and optical – and to the luminary.

LED array holder made from ForTii

Example of discoloration in heat aging simulations

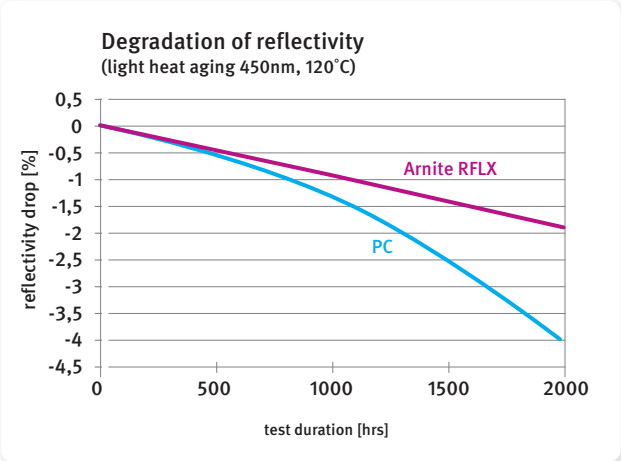
The fine metal inserts in the ring cannot resist high forces caused by the material flowing into the mold, yet a high fill rate is required to secure stiffness, with a good flammability rating (V0 at 0.2mm) and bright white color. After molding, the ring must survive the screw force from the fixation to the luminary, and the white color must survive the high temperatures required to reflow solder the LED array to the ring without discoloration.
ForTii has proven itself the material of choice to successfully meet all of these challenging requirements.

Diffuse reflectors: Arnite® RFLX

Traditionally, white diffuse reflectors are made from polycarbonate. Leading manufacturers in the lighting industry approached DSM to find an alternative. Although special polycarbonate grades are available with improved discoloration performance, the current levels of discoloration, when combined with the very long lifetimes of LED solutions, are a key factor in unattractive appearances and light output drops of LED solutions.

Building on the intrinsically good resistance of polyesters against light/heat degradation and DSM's knowledge on the physics of the degradation and discoloration of polymers, DSM developed Arnite RFLX. Flammability requirements remain tough for this application (V0 and 5VA at thin walls), and the initial reflectivity must be at least on par with the current commercially available solutions.

Recent test results revealed that Arnite RFLX significantly outperforms one of the best-available polycarbonates in light/heat degradation tests. Arnite RFLX has a UL94-V0 flammability at 0.75mm, superior to even the best polycarbonate alternatives. As a result, the thickness of the reflector can be minimized to save on material costs and improve injection molding cycle times.



Accelerated light/heat aging test results for Arnite RFLX

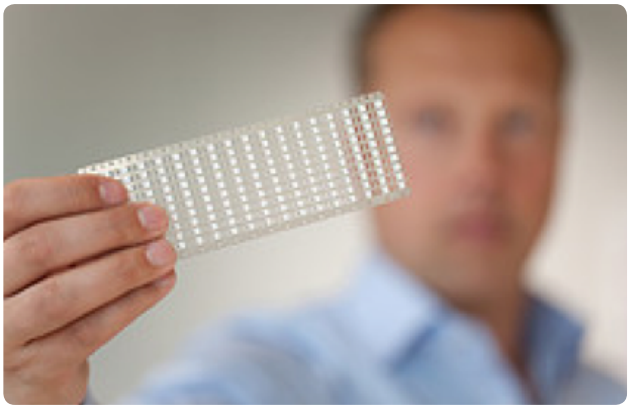
Terminal blocks: ForTii

Bright white colors are crucial for terminal blocks connecting to printed circuit boards (PCBs) that carry LEDs. Any variation or discoloration disturbs the aesthetics of the LED solution.

Weco "SMarTconn" terminal block

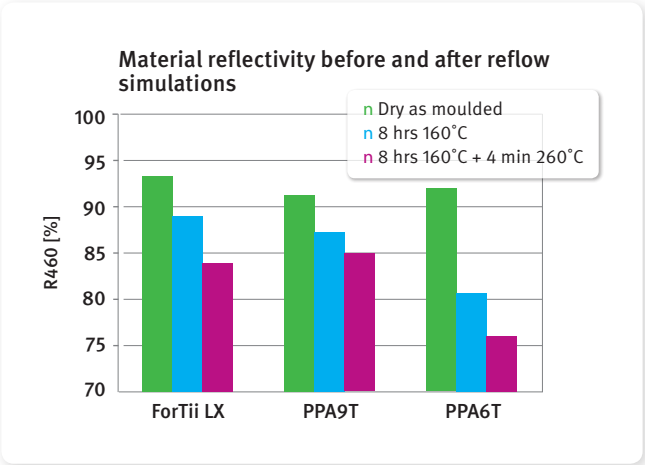
The combination of suitability for high-end connector applications, UL certification, and the bright white colour has led a number of key players in the industry to choose ForTii T11 and F11C for their terminal block applications.

ForTii is an innovative high-temperature polyamide 4T that delivers UL94-V0 flame retardency together with outstanding thermal and mechanical performance. This high-flow material is a mineral-filled grade with resistance to the near UV light and heat generated in the LED chip, that sets a new standard for LED packages.



LED packaging: ForTii LED LX

In early 2013, DSM introduced ForTii LED LX. This high-flow material is a mineral-filled grade with UV resistance that sets a new standard for LED packages. ForTii LED LX delivers reliable performance over time, with high initial reflectivity and excellent mechanical strength.



Its high flow properties make it suitable for use in tools with over hundred cavities, and its excellent reflectivity has an immediate positive effect on the light output of the LED package, enabling LED suppliers to improve their key specifications.

ForTii LED LX outperforms competitive PPAs due to its specific polymer structure. It delivers high reliability and LED lifetime via its excellent adhesion to silicone, epoxy encapsulates and the metallic lead frame, avoiding chip degradation due to moisture or air diffusion via interfacial delamination phenomena.

DSM's dedication to the lighting segment has materialized in the development of a set of reflective materials formulated to meet the specific requirements of the lighting industry. Breakthrough solutions are now available in both the high-temperature applications – where materials need to resist the harsh environment of the reflow oven– and in medium-temperature applications – where the critical requirement is long-term resistance to heat and radiation from the LED.

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