Multi-layer tubes and hoses

New adhesion grade chemically bonds to polyamides, delivering best of both materials

Today, the requirements for tubes and hoses, particularly in automotive applications, are becoming more challenging. Higher under-the-bonnet temperatures and more chemically aggressive biofuels and other fluids demand increased performance. At the same time, there is a continuing drive to reduce system costs in automotive components.

Polyamides and thermoplastic copolyesters (TPCs) are well known in the tube and hose industry. Both offer specific advantages and drawbacks. Polyamides, especially PA11 and PA12, feature excellent chemical and hydrolysis resistance but lack flexibility at low temperatures and have a lower maximum use temperature. They are also expensive materials and utilize plasticizers that are under scrutiny for environmental impact.

TPCs, which are less expensive, remain very flexible over a broad temperature range without the need for plasticizers and have excellent high- and low-temperature properties, but only have above-average chemical and hydrolysis resistance.

DSM Engineering Plastics saw an opportunity to combine the excellent features of these materials.

However, the key challenge was the adhesion of copolyester and Polyamide, as these polymers do not bond to each other. Typically, adhesion between the two requires a reactive tie-layer. However, it is difficult to find a suitable tie-layer that shows reactivity to both Polyamide and copolyester.

An Arnitel thermoplastic copolyester (TPC) adhesion grade was developed that provides high reactivity with Polyamides. In hydraulic hoses, the good chemical resistance of PA11 or PA12 can be combined with the high temperature resistance and intrinsic flexibility of Arnitel. A multi-purpose concept comprises a thin layer of PA11 or PA12, a tie layer of the Arnitel adhesion grade and an outer layer of regular Arnitel (e.g., PM581). The adhesion between the Arnitel and Polyamide layers in a tube is very good. Submerging the tube in boiling glycol/water for several hours did not affect the bond. The Arnitel adhesion grade also exhibits excellent processing behavior and good high-temperature properties.

For more information, please turn page.

Eco+ solution
Replacing mono-layer plasticized-PA11 or PA12 hoses and tubes with a combined Polyamide and Arnitel construction reduces the use of plasticizers that can impact air quality.
This multi-layer approach offers several benefits:
significantly lower system costs of up to 35 percent vs. a mono-layer PA11 or PA12 solution; reduced plasticizers in the environment; and improved chemical, mechanical and thermal resistance for demanding applications such as auto fuel lines, hydraulic hoses, HVAC hoses and vacuum brake or air brake tubes.

Importantly, this technology is available for all co-extrusion applications (e.g. tube, film, 2K co-injection molding).

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