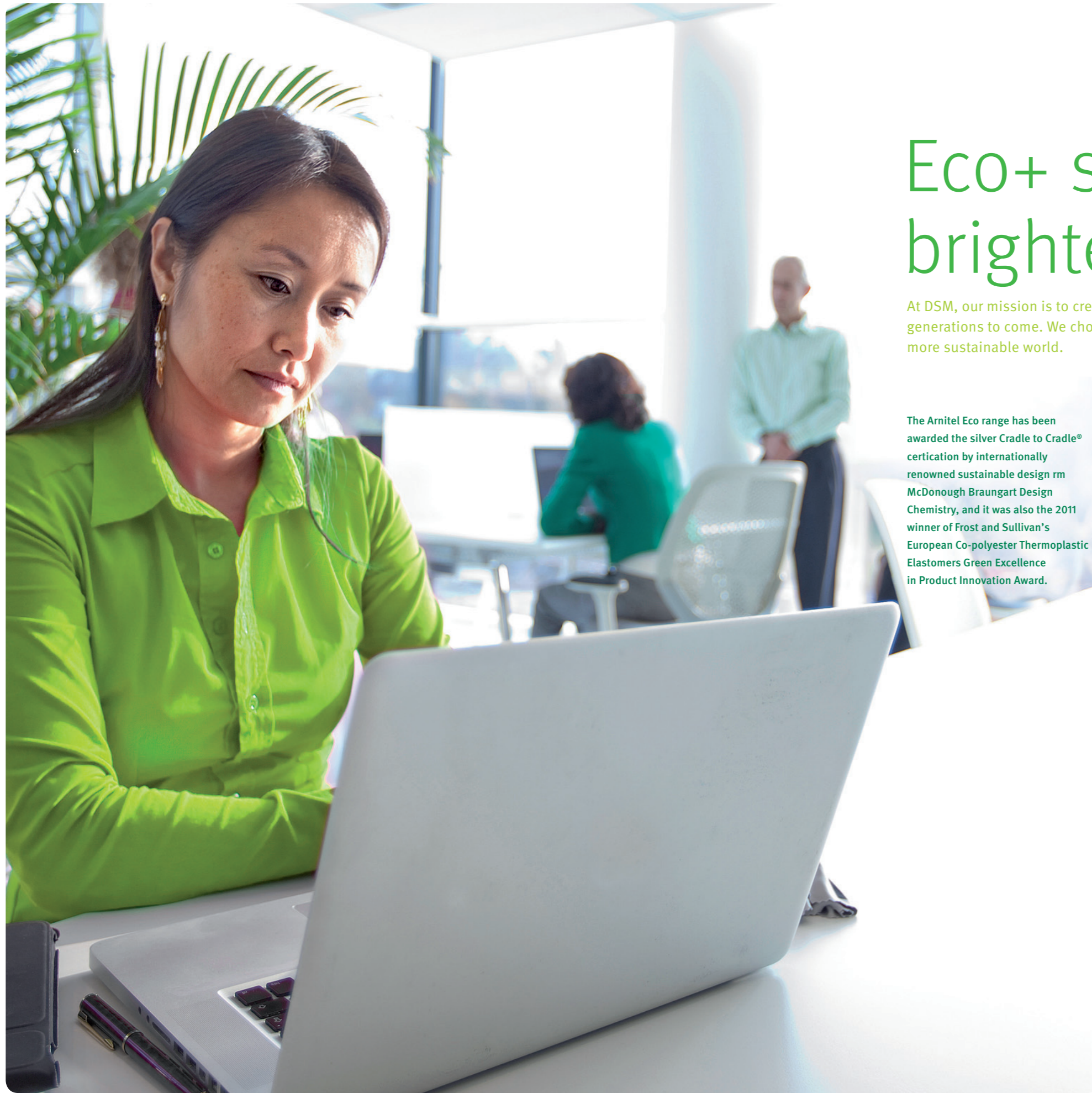


Arnitel[®] Eco



The next generation of
bio-performance materials





Eco+ solutions for a brighter world.

At DSM, our mission is to create brighter lives for people today and for generations to come. We choose activities that actively contribute to a more sustainable world.

The Arnitel Eco range has been awarded the silver Cradle to Cradle® certification by internationally renowned sustainable design firm McDonough Braungart Design Chemistry, and it was also the 2011 winner of Frost and Sullivan's European Co-polyester Thermoplastic Elastomers Green Excellence in Product Innovation Award.

Eco+ solutions

DSM's innovative portfolio of Eco+ solutions helps our customers to reduce the environmental impact of their applications. One solution is Arnitel® Eco, a high-performance thermoplastic co-polyester (TPC) made partially from renewable rapeseed oil in place of mineral oil that significantly reduces CO₂ emissions from cradle to gate.

Products with less environmental impact

"Together, we are facing critical challenges: climate change, scarcity of resources, population growth and increased consumption," says Francis Aussems, Innovation Manager at DSM Engineering Plastics.

"We need to design and build smarter products with less environmental impact, and we need to transition from an economy based on fossil fuels to one based on sustainable bio-materials. At DSM, we want to lead this transition. It's one of the key drivers for our business."

A broad portfolio

Our products include Eco+ solutions proven to contribute to a greener planet. DSM's offer includes a halogen-free portfolio, recycle-based materials, bio-based high-performance polymers, hazardous-substance-free materials, as well as materials that extend a product's serviceable lifetime, provide significant reductions in weight or friction, and help to deliver a low or neutral carbon footprint.

"DSM is uniquely positioned to create innovative Eco+ solutions that bring added value to our customer's applications," says Francis. "We combine an extensive customer network with innovative research and development potential and the passion of our people to develop Eco+ solutions that bring sustainability to life."

Arnitel Eco is derived from renewable resources, contributing to a brighter future.



Arnitel Eco: a proven green performance plastic for unique applications.

Proven less impact

At DSM, we recognize that the use of renewable raw materials is not sufficient on its own to make a product green. That's why we commissioned product lifecycle assessments (LCA) to prove that our new solutions have less impact on the environment.

To assess the reduction in greenhouse gas emissions, Arnitel Eco was measured against classic co-polyesters using a cradle-to-gate LCA. This assessment incorporates the total chain of events from growing the plants until the product leaves DSM's gate. The study was carried out in accordance with the ISO 14040/14044 standards. The global warming potential of Arnitel Eco was quantified using the IPCC 2007, GWP 100a method, and compared to classic co-polyesters.

The international standard to measure renewability is ASTM D6866. This testing method calculates the renewable carbon content by measuring the difference in isotopes from new carbon (plants) and old carbon (fossil fuels). Arnitel Eco partially uses rapeseed oil in place of mineral oil, and the rapeseed is sourced from areas where it does not compete with plants grown for food.



Additional information on the sustainability profile of Arnitel Eco can be found in the Environmental Product Declaration.

Improved properties

Arnitel co-polyesters combine the strength and processing characteristics of engineering plastics with the performance of thermoset elastomers. This elastic product outperforms conventional rubbers across a variety of applications, and is available in hardnesses ranging from 40 to 70 Shore D.

Arnitel Eco does not require vulcanization to optimize its mechanical properties,

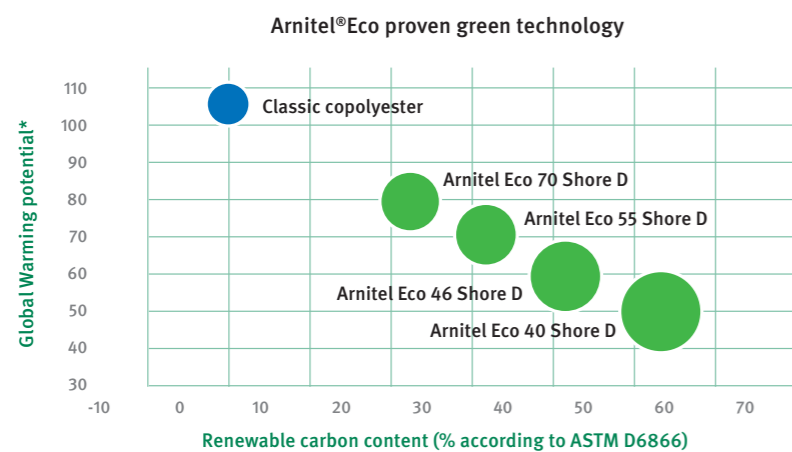
leading to substantially lower production costs. The material maintains consistent performance across its entire operating temperature from low to high extremes, outperforming other elastomers.

Long-term heat resistance

The thermo-oxidative stability of a plastic material is important in applications where the components are subjected to high temperatures over longer time periods. Arnitel Eco exhibits excellent thermo-oxidative performance even without stabilizers. The graph on the page right shows the relative change in strain at break for the 55 Shore D Arnitel Eco materials at 135°C and 150°C.

Arnitel Eco is a proven green solution. The carbon footprint of co-polyester is substantially reduced by the introduction of renewable content.

*Global Warming potential relative to classic copolyester (% according to IPCC 2007, GWP 100a)



Arnitel Eco, from cradle to gate.

Thermo-oxidative ageing in air Arnitel®Eco 55 ShoreD

Heat ageing [hours]	135°C Relative change in strain at break [%]	150°C Relative change in strain at break [%]
0	100	100
200	120	120
400	110	100
600	100	20
800	90	20
1000	80	20
1200	70	20
1400	60	20
1600	50	20
1800	40	20

Accelerated UV interior test non UV stabilized (55 ShoreD)

Exposure time [hours]	Arnitel Eco Gloss 60°	Classic TPC Gloss 60°
0	100	100
10	100	100
20	100	95
30	100	85
40	100	70
50	100	50
60	100	40

Exceptional characteristics, exceptional performance.

Other technical information on UV resistance and/or temperature dependent behavior is available on request

Peak temperature resistance

Short-term heat resistance is determined by the melting point or Vicat softening temperature, which is the temperature at which the mechanical properties of the co-polyester begin to change. Arnitel Eco has a melting point of up to 200°C, depending on hardness, and can be used in applications with peak temperatures close to the melting point. Additional details about melting points and Vicat softening temperatures are available in the product's material data sheet.

UV resistance

Arnitel Eco exhibits excellent UV resistance. The material was tested in an accelerated UV exposure test conducted in an Atlas Weather-Ometer Ci65(A) according to PV 1303 test conditions. The graph below shows the gloss of an injectionmolded sample versus UV exposure time for a classic co-polyester and for Arnitel Eco with the same hardness. The gloss is measured according to ISO 2813 at an angle of 60°C. Classic co-polyesters show severe surface cracking, creating a dull surface with a drop in gloss values. Arnitel Eco exhibits no cracking and no drop in gloss over the timed exposure, demonstrating the material's high resistance to UV light.

Contact us today to learn how DSM can help improve the carbon footprint of your designs:

Partnering for a brighter future

With an early leadership position established in the emerging market of bio-based performance materials, DSM offers a growing portfolio of composite resins and engineering plastics suitable for a wide range of industrial sectors and applications. Our bio-based products include EcoPaXX™, Palapreg® Eco and Arnitel Eco.

Arnitel Eco is suitable for applications in consumer electronics, sports and leisure, automotive interiors and exteriors, furniture, alternative energy and specialty packaging. The material is designed for a long service lifetime under extreme conditions.

At DSM, we actively seek to partner with customers to improve the environmental impact of their applications in a costcompetitive way.

Our portfolio includes a wide offer of grades with best-in-class performance at extreme operating temperatures, while considerably extending service lifetimes. We back all of our material sales with extensive research and development, as well as a collaborative partnership where we support you through grade selection, design and testing.

With manufacturing facilities on three continents, we offer a security of stock that buys our customers peace of mind, comfortable in the knowledge that supply will never be an issue with DSM.



Arnitel Eco is a high-performance thermoplastic co-polyester (TPC) made with renewable rapeseed oil in place of mineral oil. Arnitel Eco is used in:

Consumer electronics

- Unique so touch
- 2K moldable with a wide variety of materials

Sports and leisure

- Flexible
- High fatigue resistance

Automotive (interior/exterior)

- High temperature resistance
- Lower carbon footprint

Furniture

- Excellent stain resistance
- Superior abrasion resistance

Alternative energy

- High UV resistance
- Aligns with philosophy of renewable resources

Specialty packaging

- Approved for food use
- From freezer to oven



Arnitel Eco is an elastic product that outperforms conventional rubbers across a variety of applications.



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