Jetfine® talcs

for high performance polypropylene and engineering thermoplastics

- Unique ultrafine milling technology
- Improved TPO and ETP impact strength at very low temperatures
- Excellent dimensional stability
- Reduced part thickness

IMERYS Talc

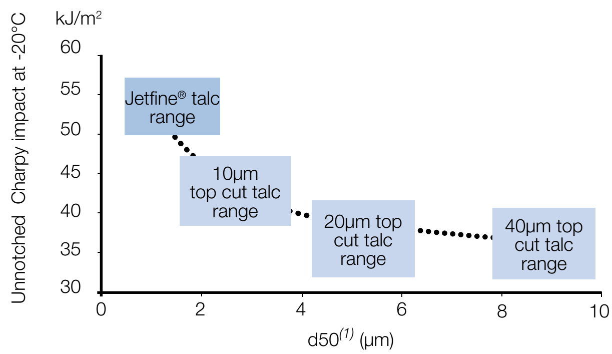
Introduction

Modifying neat thermoplastics with mineral fillers such as talc or glass fibre enables compounders to attain new performance levels for their thermoplastic olefins (TPO) and engineering thermoplastics (ETP). As the search continues for lighter and stronger car parts, Imerys Talc has developed unique jetmilling technologies to produce ultrafine talcs. Our Jetfine® range meets increasingly demanding impact resistance and dimensional stability specifications for automotive applications such as bumpers and body panels.
Jetfine® is equally suitable for electronic and electrical (E&E) parts such as computer and television housings.
Jetfine® 3 C A and Jetfine® 0.7 C A are the finest and most efficient grades in the Imerys Talc range for these applications.

Better impact performance

When the melt flow of TPOs is increased, impact strength tends to drop. The impact strength of talc-reinforced polyolefins is directly linked to the particle size distribution of the talc and to how it disperses in the matrix. To overcome any density issues due to their ultrafine grind, Jetfine® talcs are proposed in compacted form to increase bulk density and allow maximum compounding throughput. Their compaction level has been adjusted to provide an optimum handling/redispersion balance.

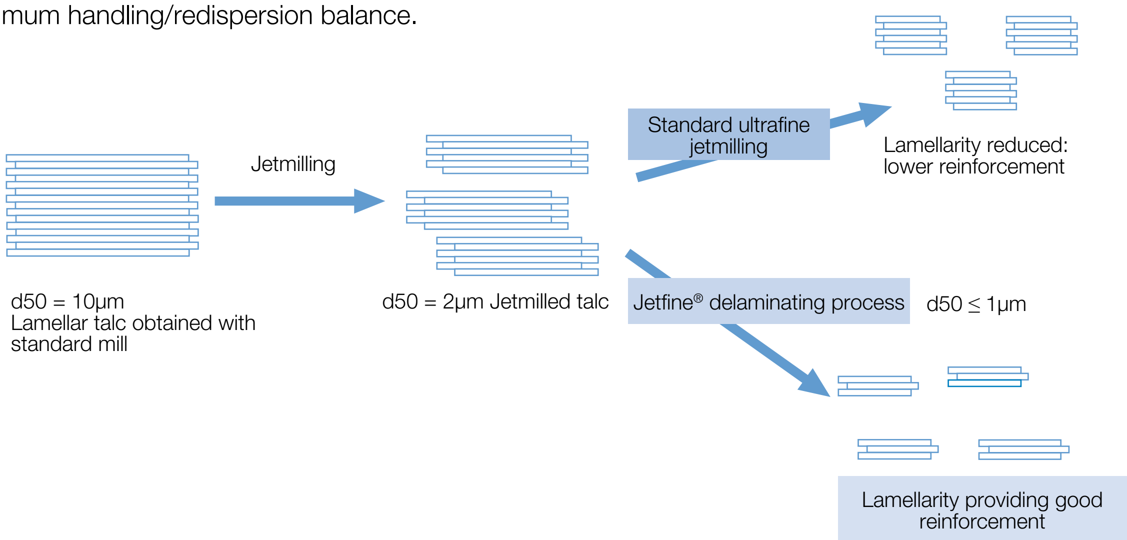
Influence of particle size distribution on impact resistance of PP compounds



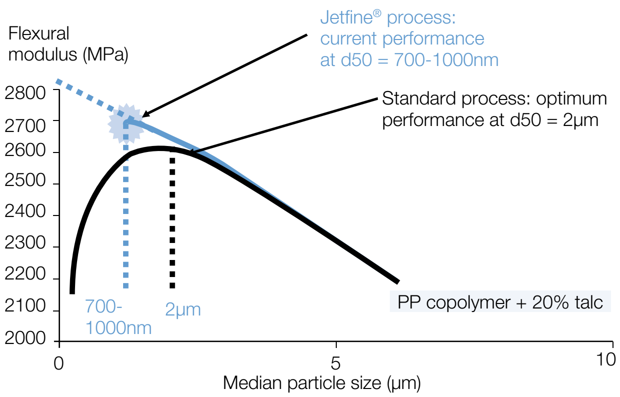
High lamellerity for optimum reinforcement

In thermoplastics, the lamellarity of the talc is key to its reinforcing efficiency. Micronisation and classification techniques are now commonly used to produce very fine talcs. However, the lower the particle size distribution, the more fragile the lamellarity—as illustrated below. We have therefore developed a unique processing technology that maintains the lamellarity of the ore for finished talcs with d50[1] as low as 0.7 microns.

(1) Measured by Sedigraph®



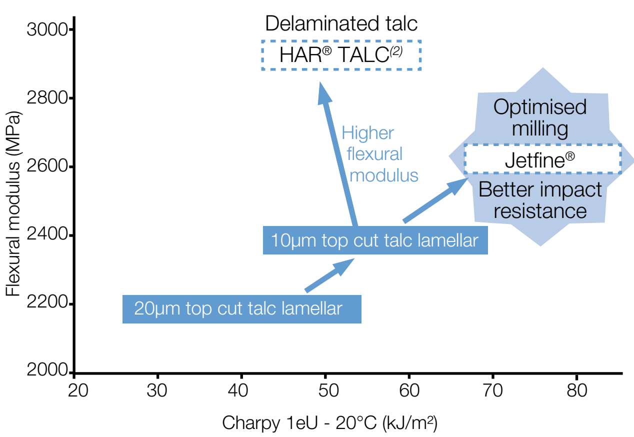
Reinforcement in relation to talc particle size distribution



Jetfine® 3 C A for low CLTE and high impact TPO compounds

The plastics industry, notably the automotive sector, is gradually switching from metal and more expensive engineering plastics to polypropylene (PP) and TPOs.
Talc is used in these applications to meet performance requirements such as greater stiffness and better dimensional control over a range of temperatures.
Our Jetfine® 3 C A (50% particles < 1000nm) has been developed specifically to meet these specifications.

Jetfine® 3 C A improves impact performance

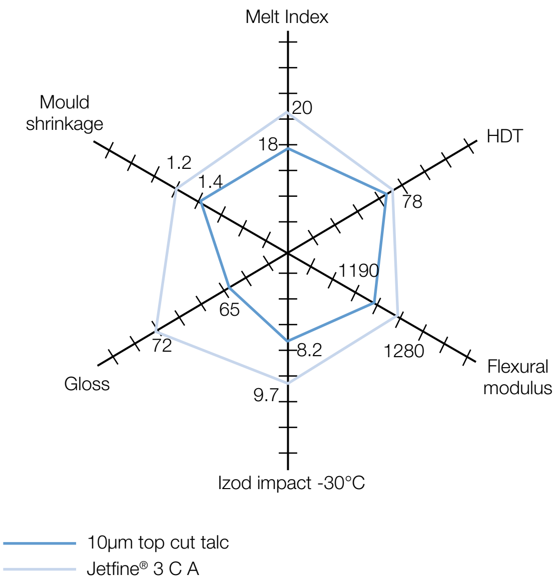


Formulation
PP copolymer: 80%
Talc: 20%
Twin screw Clextral BC21

By virtue of its high lamellar aspect ratio, Jetfine® 3 C A improves part stiffness and lowers CLTE, which leads to excellent orientation during injection moulding.

PP compound formulation examples

Jetfine® 3 C A outperforms fine talcs

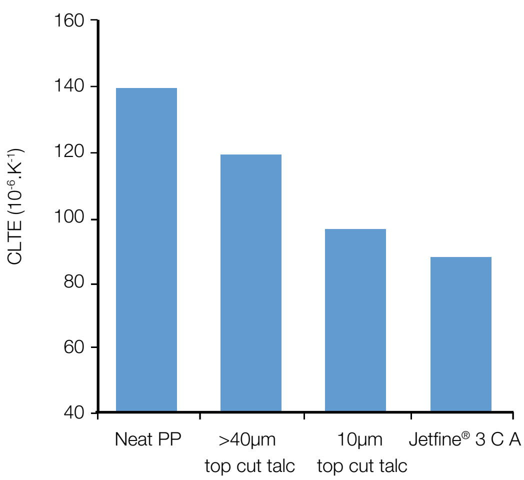


Formulation
PP copolymer high melt index + elastomer (MI 40)
Talc: 10%
Twin screw Clextral BC21

N.B.: Best values towards exterior of axes

	Fine talc	Jetfine® 3 C A
Melt index (g/10 min)	18	20
HDT ISO 75 (°C)	78	78
Flexural modulus (MPa)	1190	1280
Izod impact – 30°C kJ/m²	8.2	9.7
Gloss (%)	65	72
Mould shrinkage (%)	1.4	1.2

Jetfine® 3 C A reduces CLTE versus fine talc



Formulation
PP: 90%
Talc: 10%

Jetfine® 3 C A for high ductility TPO compounds

In high ductility TPO compounds, the concentration regions highlighted in blue on both graphs represent the formulations that offer a ductile impact at -30°C (impact energy of > 20J) and a flexural modulus of over 1800MPa. Even more stringent impact (>22J) and stiffness (>2000 MPa) requirements are identified by concentration regions highlighted in dark blue.

Larger blue concentration regions of Jetfine® 3 C A demonstrate the product's superior stiffness/toughness balance performance compared to the 10µm top cut talc.

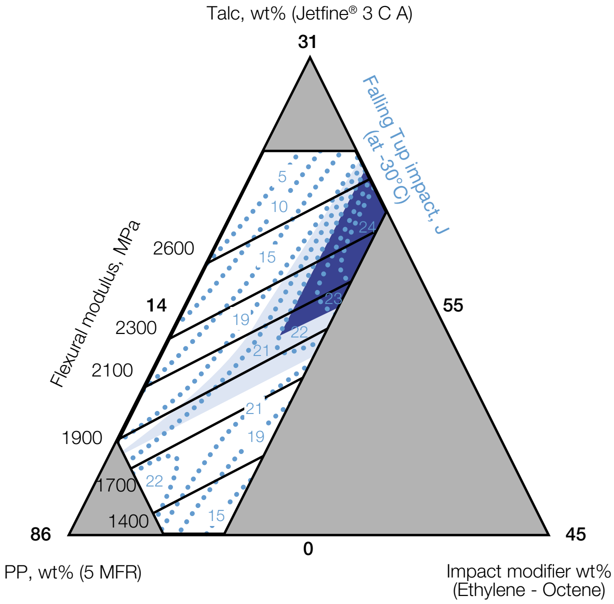


Figure 5: Flexural modulus (black lines) and falling Tup impact at -30°C (blue lines) as a function of talc (Jetfine® 3 C A), PP (5 MFR) and impact-modifier concentrations.

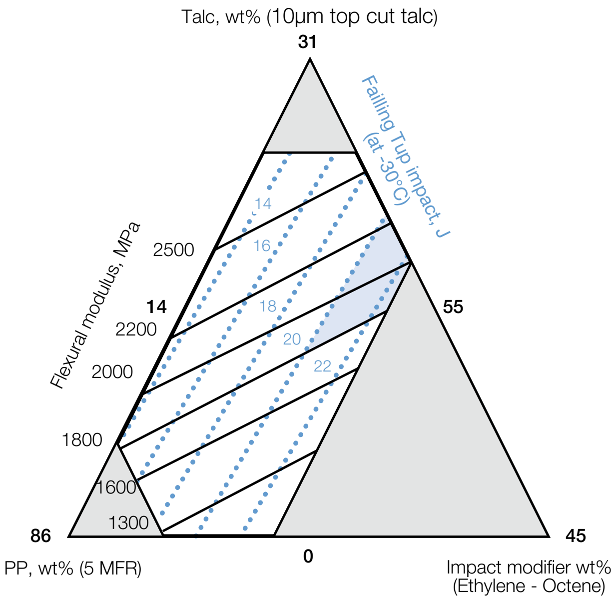


Figure 6: Flexural modulus (black lines) and falling Tup impact at -30°C (blue lines) as a function of 10µm top cut talc, PP (5 MFR) and impact-modifier concentrations

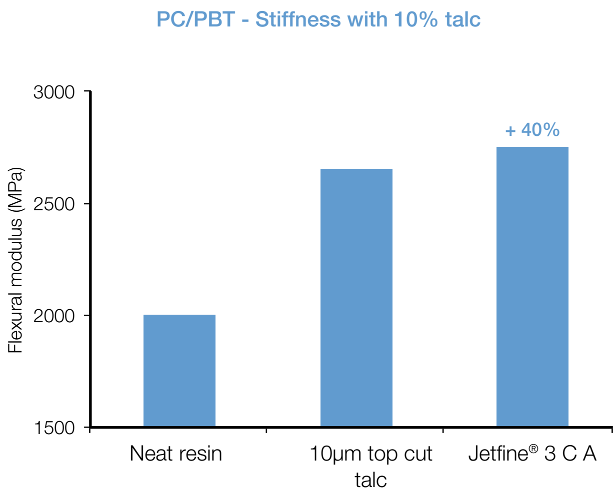
Iso-impact contours are shown by dotted blue lines and iso-stiffness contours by solid black lines on each graph within the concentration limits of each component. The concentration range for each component is shown by blue font on the graph.

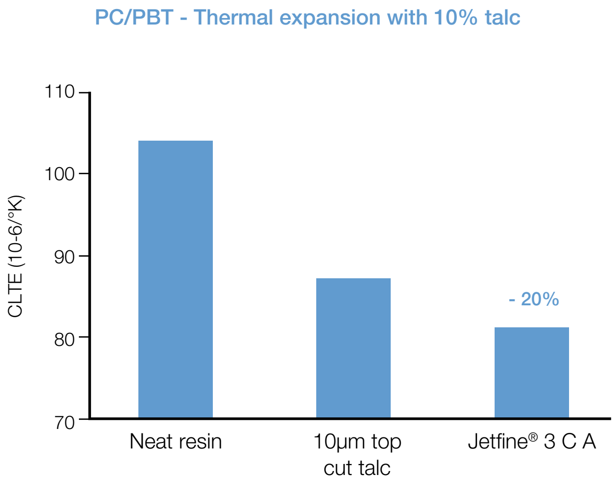
The improvement in toughness at high Impact-Modifier (IM) concentrations with Jetfine® shows that talc improves dispersion of the rubber phase in TPO formulations.

Jetfine® 3 C A for high performance engineering plastics

Engineering plastics (ETP) are widely used in automotive, and electrical and electronic parts. Reinforcing these plastics with Jetfine® talcs enhances their performance in terms of CLTE, stiffness and temperature resistance. Jetfine® 3 C A is efficient in a wide range of ETP, for example, alloys based on polyamides, polyesters and ABS.

In PC/PBT car body panels—where dimensional stability and stiffness are key requirements—adding 10% Jetfine® 3 C A to formulations increases rigidity by 40% and reduces CLTE by 20%.





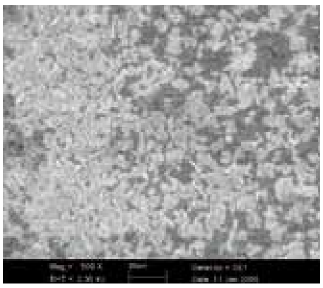
As demonstrated in the parallel-to-flow and cross-flow CLTE data shown below, Jetfine® 3 C A ensures the isotropy of the compound, resulting in excellent part geometry and low warpage, which are crucial for zero gap designs. This is an advantage versus other fillers such as acicular wollastonite or fibre glass.

In ETPs, where impact resistance is key, Jetfine® 3 C A outperforms very fine talcs providing 20% higher toughness retention.

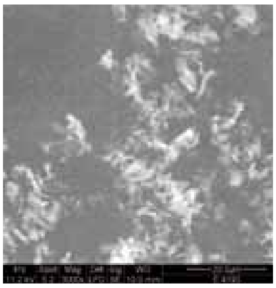
		Neat PC/PBT	10% 10µm top cut talc	10% Jetfine® 3 C A
Flexural modulus - ISO 178 (MPa)		**1990**	**2650**	**2760**
HDT - ISO 75 (°C)		**72**	**80**	**82**
CLTE 23-80°C ($10^{-6}.K^{-1}$)	Flow	98	82	75
	Cross	108	89	87
	Average	**103**	**85**	**81**
Notched Charpy impact -30°C (kJ/m^2) - ISO 179 (1eA)		**30**	**10**	**15**

Jetfine® 0.7 C A for ultra high impact compounds

The combination of stringent ore selection and a unique, delaminating jetmilling process ensures the optimum performance of Jetfine® 0.7 C A.

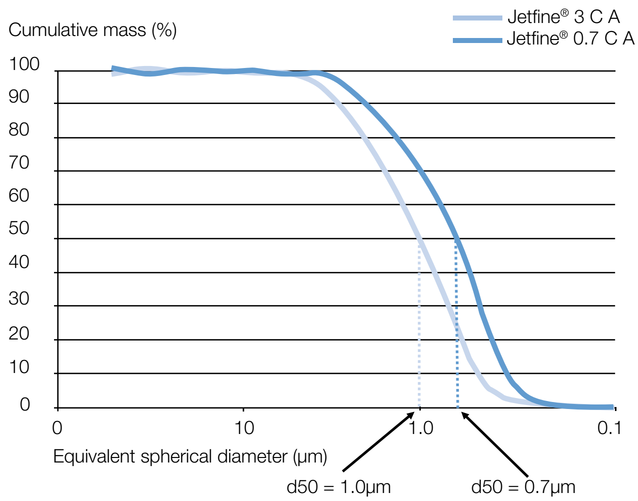


20µm top cut talc



Jetfine® 0.7 C A

Particle size distribution
Jetfine® 0.7 C A versus Jetfine® 3 C A

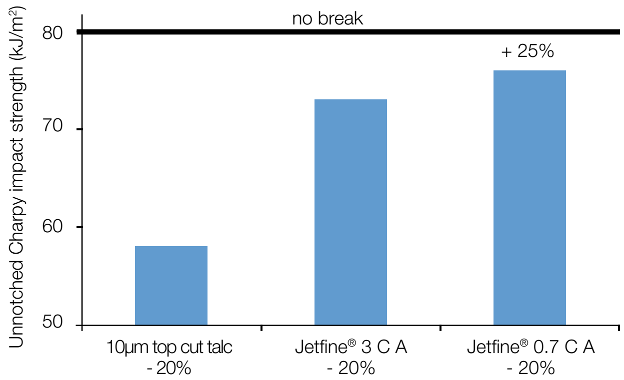


The graph below shows particle size distribution as measured by Sedigraph.
Jetfine® 0.7 C A (d50 = 0.7µm) and
Jetfine® 3 C A (d50 = 1µm).

The low d50 and precise top cut of Jetfine® 0.7 C A are key parameters for final applications.

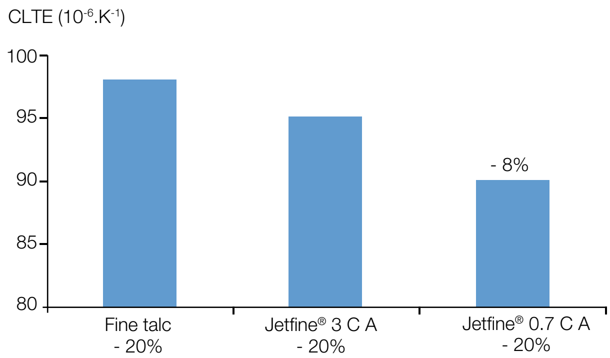
A PP copolymer formulation reinforced with 20% Jetfine® 0.7 C A was compared with a similar formulation prepared with very fine talc (d50 = 2µm; 10µm top cut talc) and Jetfine® 3 C A (d50= 1µm). With Jetfine® 0.7 C A, PP stiffness was 10% higher than the PP reinforced with 10µm top cut talc, and impact strength improved by 25%. This enhancement of impact strength is key to automotive plastic compounds where filler content has to be limited.

Impact strength of talc reinforced PP at -20°C

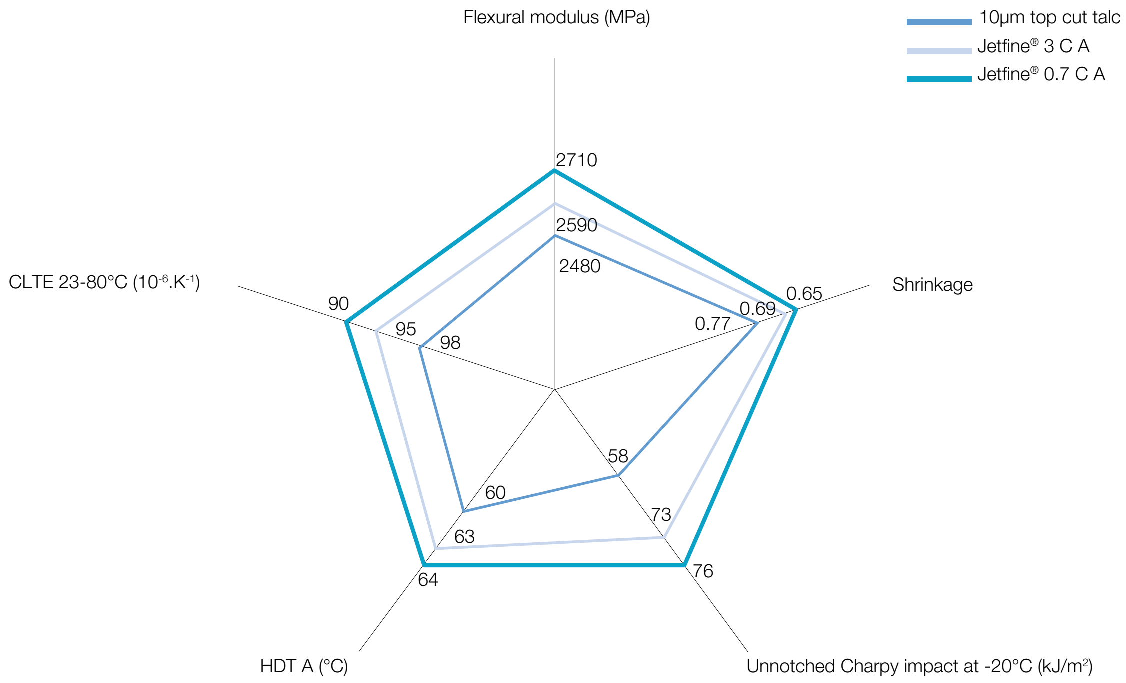


The dimensional stability of Jetfine® 0.7 C A reinforced compounds was 8% better than the PP containing very fine talcs. Jetfine® 0.7 C A is ideal for zero-gap automotive applications.

CLTE of talc reinforced PP (23-80°C)



The spider graph and following table summarise the enhanced properties of PP compounds for the three talcs compared in the study. Jetfine® 0.7 C A demonstrates superior behaviour across the complete mechanical performance spectrum.



N.B. Best values towards exterior of axes.

Sample	Neat resin	20% 10µm top cut talc (d50 = 2µm)	20% Jetfine® 3 C A	20% Jetfine® 0.7 C A
Flexural modulus (MPa)	1060	2480	2590	2710
Notched Charpy at 23 °C (kJ/m²)	15.0	10.0	8.5	9.5
Unnotched Charpy at - 20 °C (kJ/m²)	No break	58.0	73.0	76.0
Falling Tup impact at - 20 °C (J)	23.0	-	20.0	21.0
HDT A (°C)	54	60	63	64
Shrinkage (%)	1.04	0.77	0.69	0.67
CLTE 23 - 80 °C ($10^{-6}.K^{-1}$)	148	98	95	90

Jetfine® talcs are recommended for:

• Automotive exterior parts made from TPOs and ETP fascias, body or rocker panels,

• Automotive interior parts made from polypropylene, PC/PBT, PC/ABS, etc.,

• E&E parts such as computer housings made from engineering plastics.

Recommended talcs

Jetfine® 0.7 C A
Jetfine® 3 C A
Jetfine® 3 C C

Experimental data

Compounding

Twin screw extruder Clextral BC21 D = 25mm, L/D = 36.
Injection moulding on Billion, 50T.
All compounds and specimens were produced in Imerys Talc's laboratories.

Mechanical properties

Specimens tested in accordance with:
Flexural modulus - ISO 178
Charpy impact - ISO 179
HDT ISO - 175 A
Shrinkage - ISO 2577
CLTE - internal method
All tests were performed in Imerys Talc's laboratories.

About Imerys Talc

Imerys Talc is the world's leading talc producer, employing 1,000 people on five continents and supplying around 15 percent of world demand from our mines and processing plants in Australia, Austria, Belgium, Canada, France, Italy, Japan, Spain and the United States.
We are the acknowledged leaders in product quality, supply reliability and technical support – the services that create value for our customers and set us apart from competitors.
With over a hundred year's experience in the extraction and processing of talc, we offer the highest quality talc products on the market today.

About Talc

Talc is a surprisingly versatile, functional mineral which possesses a unique combination of properties. Talc is soft, water repellent, chemically inert and highly platy and has a marked affinity for certain organic chemicals. Our industry experts have harnessed these properties to bring customers improved performance in a wide range of applications such as paper, paints, plastics, rubber, ceramics, agriculture, food, pharmaceuticals, cosmetics and soap.

Meeting today's needs. Securing tomorrow's.

We believe that running a successful business and sustaining quality of life and the environment go hand in hand. From implementing behavior-based safety training to rehabilitating the land, we think it's important that future generations' needs are not compromised by our actions today.

Our fundamental sustainability principles are:

- **Safety** - We promote the health and safety of employees, contractors, customers, neighbors and consumers through active caring.
- **Partnership** - We seek to understand the issues that are important to our neighbors, and to make a lasting contribution to the communities in which we operate.
- **Environmental protection** - We work to minimize our environmental footprint by using natural resources efficiently, preventing pollution, complying with applicable laws and regulations and continually improving our performance.
- **Accountability** - We conduct business in an accountable and transparent manner, relying on external auditing and reporting to understand and reflect our stakeholders' interests.
- **Product stewardship** - We are committed to ensuring that our products are safe for people and the environment, employing best available technology and following best-in-class procedures to ensure that our standards and practices meet or exceed safety requirements everywhere we do business.

We conduct life cycle assessments (LCA) at all our operations to quantify the environmental effects associated with producing our products from the mine to factory gate, and to identify areas for improvement.
Likewise, we compile life cycle inventories (LCI) of the energy consumption, materials used and emissions generated by each of our product ranges. These LCI can be made available to customers and research institutions on request.