Latest Talc Developments for High Performance, Lightweight Polyolefin Compounds

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World Leader in Mineral-Based Specialty Products

2014 Sales* €3,688 million
15,800 employees in 50 countries
234 locations

*2014 consolidated sales

Market Positions

Energy Solutions & Specialties (35% of sales*)
World #1 in:
- alumino-silicate monolithic refractories (Calderys)
- graphite for alkaline batteries and conductive additives for Li-ion batteries
- lubricants for seamless tube protection
- natural graphite powders
- minerals for breathable polymer films (GCC)
- World #2 in ground calcium carbonate (GCC) for paper

Filtration & Performance Additives (18% of sales*)
World #1 in:
- diatomite and perlite-based products for filtration, personal care and coatings
- mica for engineered plastics, high performance coatings and personal care
- talc for plastics, paints, paper, ceramics, health & beauty, rubber, agriculture
- kaolin for coatings and personal care

Ceramic Materials (31% of sales*)
- World #1 in kiln furniture for roofing tiles
- World #1 in raw materials and ceramic bodies for sanitary ware
- World #2 in kaolin for fiberglass
- French #1 in clay roof tiles

High Resistance Minerals (16% of sales*)
World #1 in:
- fused silica
- fused minerals for abrasives
- fused zirconia
- alumino-silicate minerals for refractories

IMERYS
Imerys Materials: Portfolio for Polymer Applications

Kaolin  Graphite  Diatomite  PCC  Talc
GCC  Mica  Feldspar  Perlite  Carbon Black
Automotive Market Drivers

- **Cost reduction:** Global Specifications for new materials given by OEMs to compounders
- **Lightweighting** is the most important parameter that OEMs are looking for in new automotive design before engine (down) sizing and EV (WardsAuto);
- Performance improvement: trend for **lower Density**
  - PP began in 2013 focusing on instrument panels and fascia
    - from 18-20% to 12-15% talc
- **Foaming** of parts, specifically instrument panels, will continue
- **Safety:** improving interior cabin environment (low VOC, odour, fogging)
- **Sustainability:** **Recycling** is increasingly part of the automotive TPO equation
  - polyolefins/engineering plastics recovered from shredded ELV
Creating Mineral Products / Aspect Ratio of Minerals

Macro structure (particle size, shape and organisation)

- Broad particle size distributions
- Calcined minerals
- Narrow particle size distributions
  - Supercoat®, Jetfine® talc
- Controlled top cuts
  - Filmlink®, FiberLink®,
- Agglomerated and structured materials
  - Neogen®, Compacted talcs
- High aspect ratios
  - Mica, Barrisurf®, Talc HAR®,
- Treated minerals
  - Polarite®, Mistrobond®

Calcium Carbonate
Talc
Kaolin
Wollastonite, Mica
Graphite

sphere
5:1
12:1
30:1
60:1

0.5µm
0.73µm
1.1µm
1.9 µm
2.5 µm
Minerals for Plastic Foaming (Mistrocell™)

- **Market trend:** Global warming concerns (legislation to reduce energy demand by 20% by 2020), material reduction in packaging, sustainability, cost savings.
- **Need:** Develop lightweight materials by foaming polymers with a **more efficient mineral in nucleation** (more regular cell structure with density and size)
- **Innovation:** New mineral patented product range using:
  - lamellar chloritic talc (film, extrusion)
  - micro-lamellar talc (injection moulding, construction);

**Solution**

- **Mistrocell®** product range: selected and patented talc grades for different conversion technologies
  - **Automotive:** Foamed injection molded parts using Mucell process (automotive plastic interior trim, lightweighting target 30%, 10-15% of talc, aesthetic issue, maintain rigidity and high dimensional stability)
Jetfine® Talc for Optimum Stiffness/Impact Balance

Fineness and lamellarity improve talc compound mechanical performance, and dimensional stability

- Polyolefin and engineering thermoplastic compounds need to improve stiffness/impact balance
- Jetfine® range developed to meet the required targets:
  - Lamellarity preserved for reinforcement
  - Precise top-cut for impact strength
  - Medium particle size down to 1 µm
Jetfine® brings excellent scratch resistance and enables optimized scratch additive loading in TPOs (trials performed with GMW 14688, 10N on smooth plaques)

Jetfine® reduces scratch damage by up to 70% vs. coarse talc
Specific reinforcement is mainly triggered by talc lamellarity.

- It influences and optimises stiffness, HDT, shrinkage and CLTE.
- So there is a good reason for maintaining or even improving lamellarity.

**HAR®-PROCESS:**
- Proprietary delaminating process developed by Imerys.

**Lamellarity Index:**
\[(d_{50\text{ sedi}} - d_{50\text{ sedigraph}})/d_{50\text{ sedi}}\]
HAR® Talc for Superior Plastics Reinforcement

Superior reinforcement enables mineral content reduction.

In a TPO formulation:
20% 7µm talc replaced by 15% HAR® talc

5% weight savings without altering mechanical performance
HAR® T84 evaluated at high loading in PP copolymer formulation

- **HAR® T84** use in PP copolymer enables design of high stiffness PP
- Flexural modulus higher than 5000 Mpa
- Thermal expansion of HAR® reinforced composites reduced to 30-40 10^-6/°C
- Ideal solution for thermoplastic body panels
Mistron HAR®: Improved Impermeability Technology for Tyres

- **Market trend:** reducing energy consumption → lowering tyre rolling resistance and therefore fuel consumption. To maintain tyre performance, liner air retention must be improved.

- **Need:** Better polymers (shift from natural rubber to more expensive butyl rubbers) and more impermeable additives to achieve better liner air retention (reduce tyre weight by inner liner down-gauging)

- **Innovation:** New mineral using delamination technique (wet milling) with micro lamellar talcs

**Solution**

- **Mistron® HAR brings 40% air permeability reduction**
  
  - The concept of liner down-gauging is relevant for truck tyres (average truck tyre liner thickness is 2-2.5 mm), average truck tyre weight is 50kg. The inner liner represents 10% of tyre weight, the average mineral loading in liners is 15% (e.g. HAR®).

  - Mistron® HAR has been approved and is used by main truck and passenger tyre producers
Conclusions

- Mistrocell® offers:
  - Possibility to produce 30% lighter injection moulded parts through improved cell nucleation

- Jetfine® Talc offers:
  - Unique stiffness/impact balance
  - Reduced scratch and mar appearance
  - Lower price version for less bright or non visible applications

- High Aspect Ratio (HAR®) Talc offers:
  - +20% reinforcement vs very fine jetmilled talc
  - Possibility to reach very low thermal expansion offering better gap control on vehicle panels
  - Opportunity for down-gauging or filler content reduction due to improved reinforcing

- Mistron® HAR offers:
  - Downgauging opportunities for tyre inner liners based on 40% improvement in air retention
Thank you for your attention