



"Aspanger MICA – the sustainable European alternative of a pure Muscovite MICA with a lower carbon footprint"

ROCK-STARS
MADE IN ASPANG

Agenda

- 1) Who is ASPANGER? – Facts & Figures
- 2) What is MICA?
- 3) Advantages of the functional filler ASPANGER MICA in paints, coatings and construction & Polymer
- 4) Actual processing of ASPANGER MICA
- 5) Future processing of ASPANGER MICA
- 6) Conclusion

1) Who is ASPANGER?

Facts & Figures

- Founded: 1856
- Owned (since 2015) 100% family owned (Pürrer & Partlic)
- Turnover 2023: 5 M €
- Market: Worldwide from US to Japan
- Employees: 21
- Overall mining: 200,000 mt / year
- Thereof MICA & ASPOLIT: 8,000 mt / year
- Certification: ISO 9001 & 14001, COSMOS
- Deposit (MICA & ASPOLIT): ~ 3 M mt



www.aspanger.com

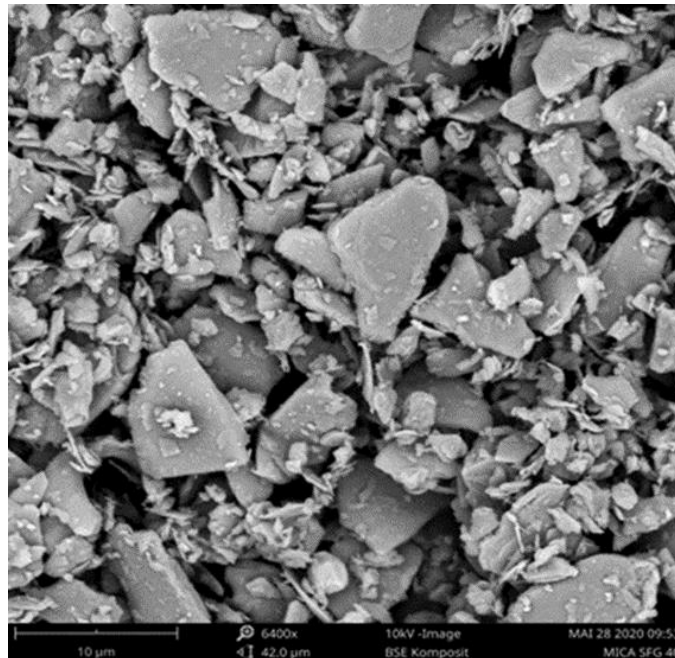


Aspanger Team

2) What is MICA?

- **Muscovite MICA** represents together with Phlogopite MICA the two industrial used MICA types. The MICA group consists of more than 30 minerals, but only these two mentioned types have a commercial significance.
- **The world`s MICA market is dominated by non-European MICA.** According to the statistics, the three biggest net exporters of MICA are **India, China and Canada**. In most of these cases we are talking about **MICA flakes from pegmatitic sources**. Pegmatitic sources are deposits, which are of magmatic origin, where the mica is present in form of **cm to dm thick MICA layers. (MICA flakes)**

- **In contrary** to these pegmatitic sources, **Aspanger**, representing a European MICA deposit, has a **sedimentary genesis** with a **weak metamorphic overprint**. Therefore, the Aspanger MICA is an excellent European alternative on the MICA market, particularly when talking about **fine grades in the meaning of MICA powder**.



- In the paints and coatings industry, a fine filler is needed to produce thin layers, therefore, MICA powder is used as functional filler. **Aspanger MICA is – due to the sedimentary genesis with a weak metamorphic overprint - extremely fine,** this means the MICA powder has a top cut (d98) of maximum 30 μm down to 7 μm – reached by **one short milling process only**. To reach the same fineness out of MICA flakes from pegmatitic deposits, **at least two processing steps** in the form of crushing and milling are needed.
- Each **processing step** will cause a slight **damage of the MICA structure** beside every additionally **production step** will **increase the cost** for the filler.

- Furthermore, in respect to its chemical composition, **Aspanger MICA has a very low content of heavy metals.** Consequently, it can be used for ecological paints as well. (**COSMOS approval** – Aspanger MICA is allowed being used as functional filler in the even **natural Cosmetics industry** because of the **extremely low heavy metal content**)



**COSMOS
APPROVED**

Heavy metal content

- Example: Guideline for Cosmetics industry
- Listed Elements: As, Sb, Hg, Cd & Pb
- Limits:

| | |
|-----------------|-------------------|
| As ^a | < 2,5 ppm (2,4)* |
| Sb | < 0,5 ppm (0,13) |
| Hg | < 0,1 ppm (0,001) |
| Cd | < 0,1 ppm (0,08) |
| Pb ^b | < 5 ppm (1,9) |



^a for theater, fan or carnival make-up

^b for the products make up powder,rouge, eyeshadow, eye liner, kajal, as well as theater,fan or carnival make-up

*analysis from external laboratory EuroMinerals 08/23

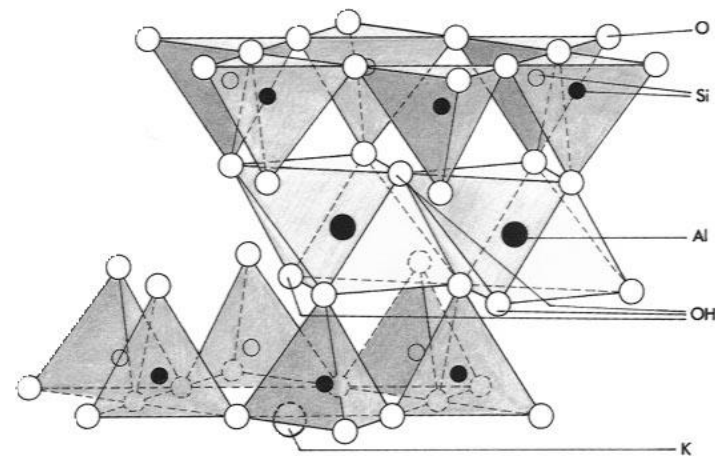


**COSMOS
APPROVED**

- **Aspanger MICA is not labelled** (up to MICA SFG 40) due to **crystalline silica content < 1%**. See MSDS chapter 02.
- Every filler needs to be labelled in case the **crystalline silica content** (quartz particles < 10 μm) is > 1% but < 10%. In this case the filler needs to be labelled (**H373**) with the symbol  and the wording "**Caution**".
- Every filler needs to be labelled in case the **crystalline silica content** (quartz particles < 10 μm) is > 10%. In this case the filler needs to be labelled (**H372**) with the symbol  and the wording "**Danger**".

What is Muscovite MICA?

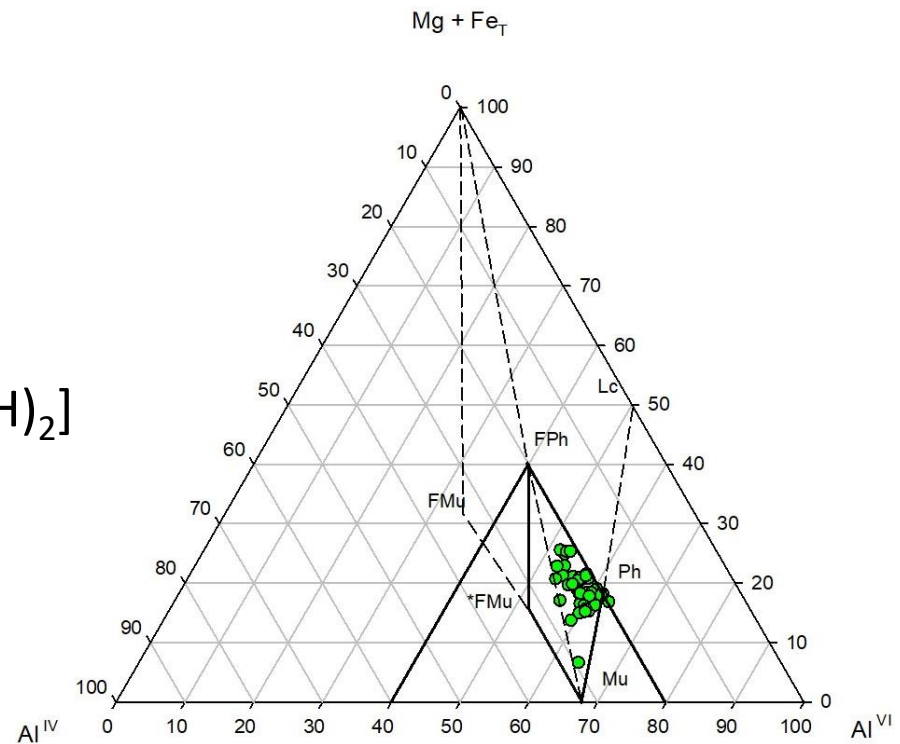
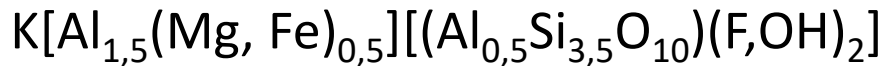
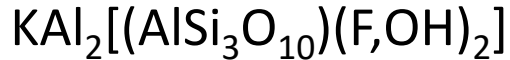
- Formula $\text{KAl}_2[(\text{AlSi}_3\text{O}_{10})(\text{F,OH})_2]$
- Color white, silver
- Cleavage perfect {001}
- Hardness 2.5
- Density 2.85 g/cm^3



What is Aspanger Muscovite MICA?

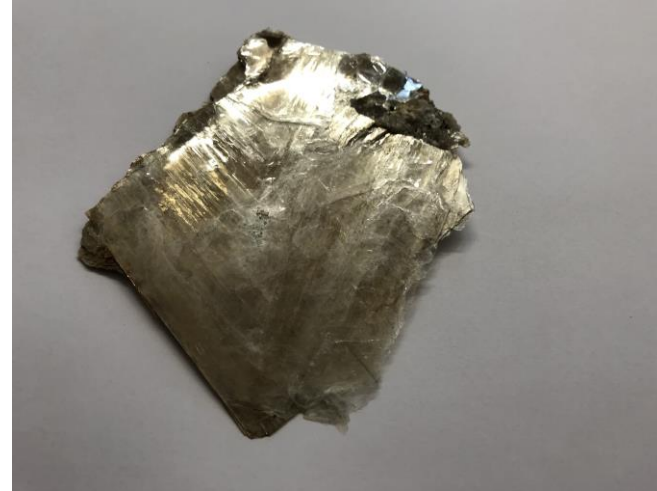
Muscovite → Phengite

Ideal formula



MICA deposits

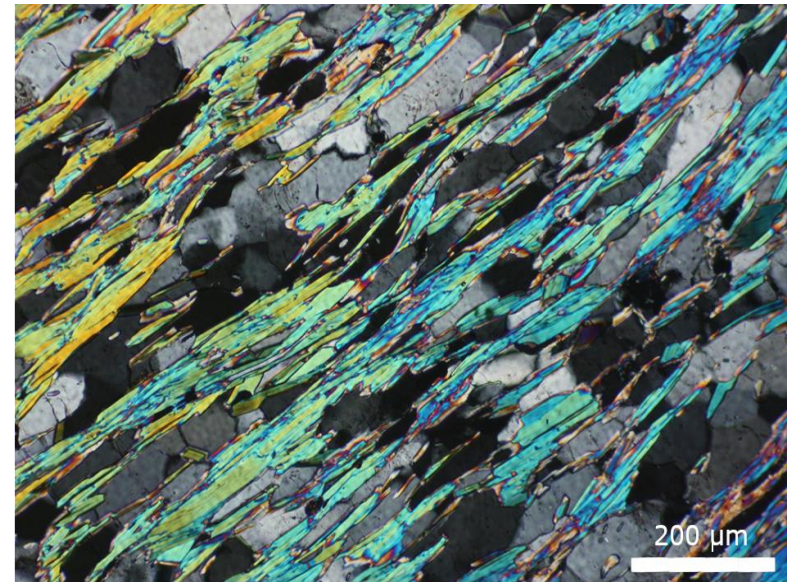
- Muscovite MICA is: a rock forming mineral
- Appearance/deposits: pegmatitic rocks/leucophyllite



Leucophyllite (Type Aspang)



Current Aspanger open quarry III



Leucophyllite under microscope

Leucophyllite (Type Aspang)

- **Mining activity since 1856**
- **Deposit will last for more than the next 100 years**
- **Sedimentary genesis** with a weak metamorphic overprint
- **Type Aspang is unique**
 - a) **extremely fine mineral structure** (short milling time to produce MICA powder)
 - b) **very low heavy metal content**
 - c) **purity** – due to very low quartz content the **crystalline silica** content (particels < 10 µm) is less than 1% - **no labelling issue**
 - d) **only European Muscovite MICA** which is **produced 100% at one production site** (Mining & processing the MICA powder)

**3) Advantages of the functional filler
ASPANGER MICA & ASPOLIT
in paints, coatings and construction
& Polymer**

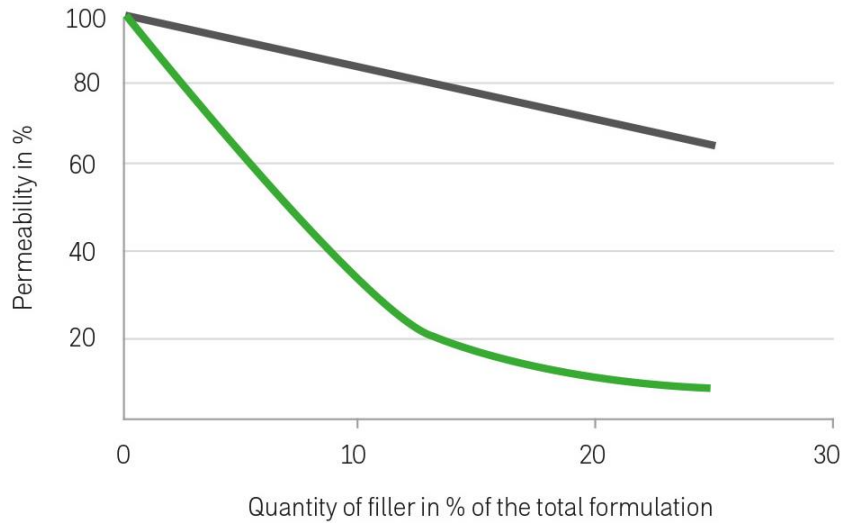
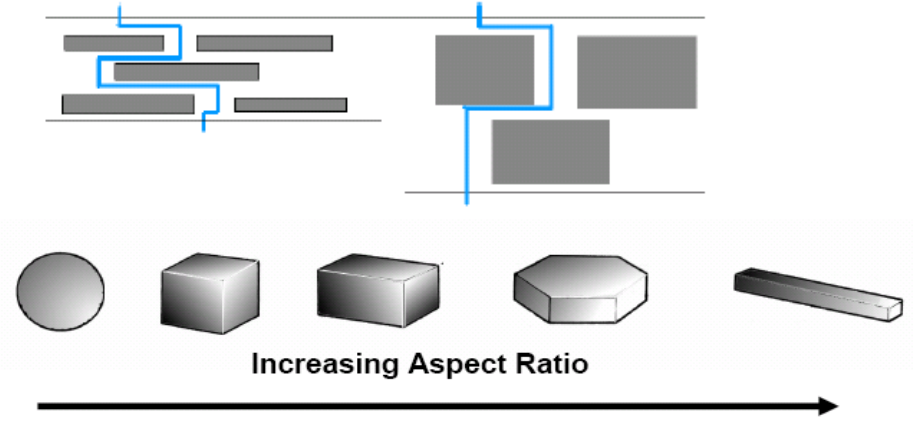
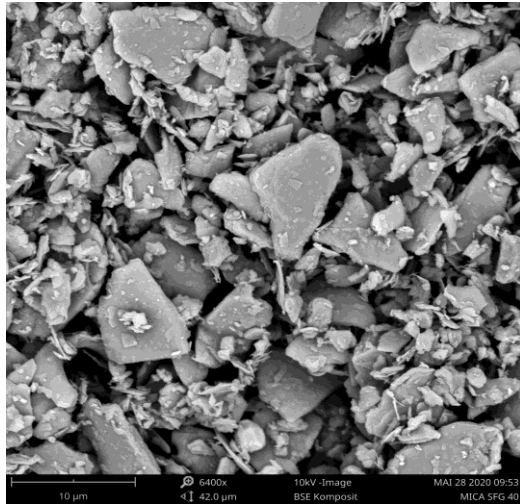
Comparison Silicate fillers

| | Mica / Aspolit | Talcum | Kaolin |
|----------------------------|--|--|-----------------------|
| Main differences | | | |
| Mohs hardness | 2.5 / (2.5 / 7) | 1 | 2 |
| Aspect ratio | – 60:1 | – 30:1 | – 15:1 |
| Benefits | Excellent wettability (low oil absorption) Reduction of permeability (e.g. anti-corrosion due to high Aspect ratio) | | |
| Polarity | hydrophilic | surface (hydrophobic), edge (hydrophilic) | hydrophilic |
| General information | | | |
| pH-value | 9.5 | 9 | 4.5 – 7.5 |
| Refractivity | 1.56 | 1.57 | 1.56 |
| Density | 2.85 / 2.75 | 2.75 | 2.6 |
| Particle structure | lamellar, flat and platy | lammellar, wavy and platy | lamellar |
| Chemical resistance | ✓ (except HF acid) | ✓ (except HF acid) | ✓ (except HF acid) |

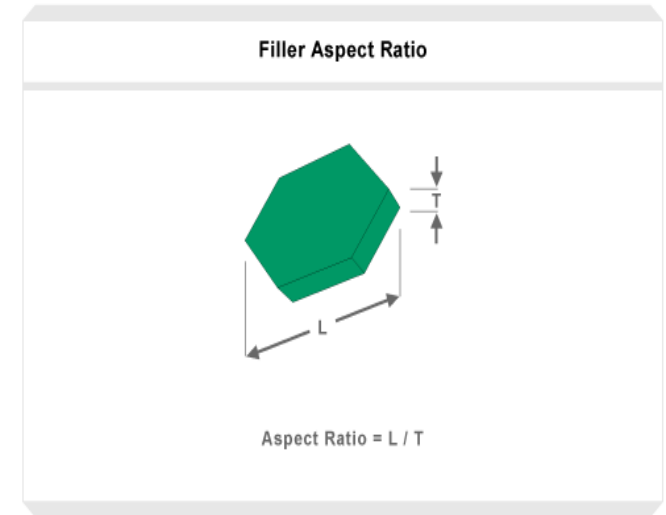
Why MICA & ASPOLIT in paints, coatings & construction?

- 1.) Excellent wettability due to low oil absorption
- 2.) Increases opacity & coverage
- 3.) Reduces pinhole effect, cracking & shrinkage
- 4.) Reduces visibility of overlapping
- 5.) Ensures good adhesion (mineral structure)
- 6.) Reduction of permeability
(e.g. anit-corrosion effect due to aspect ratio)
- 7.) UV, IR and chemical resistance
- 8.) Excellent Dispersibility (hydrophilic polarity)
- 9.) Improves wet rub resistance
(mainly Aspolit because of abrasion)

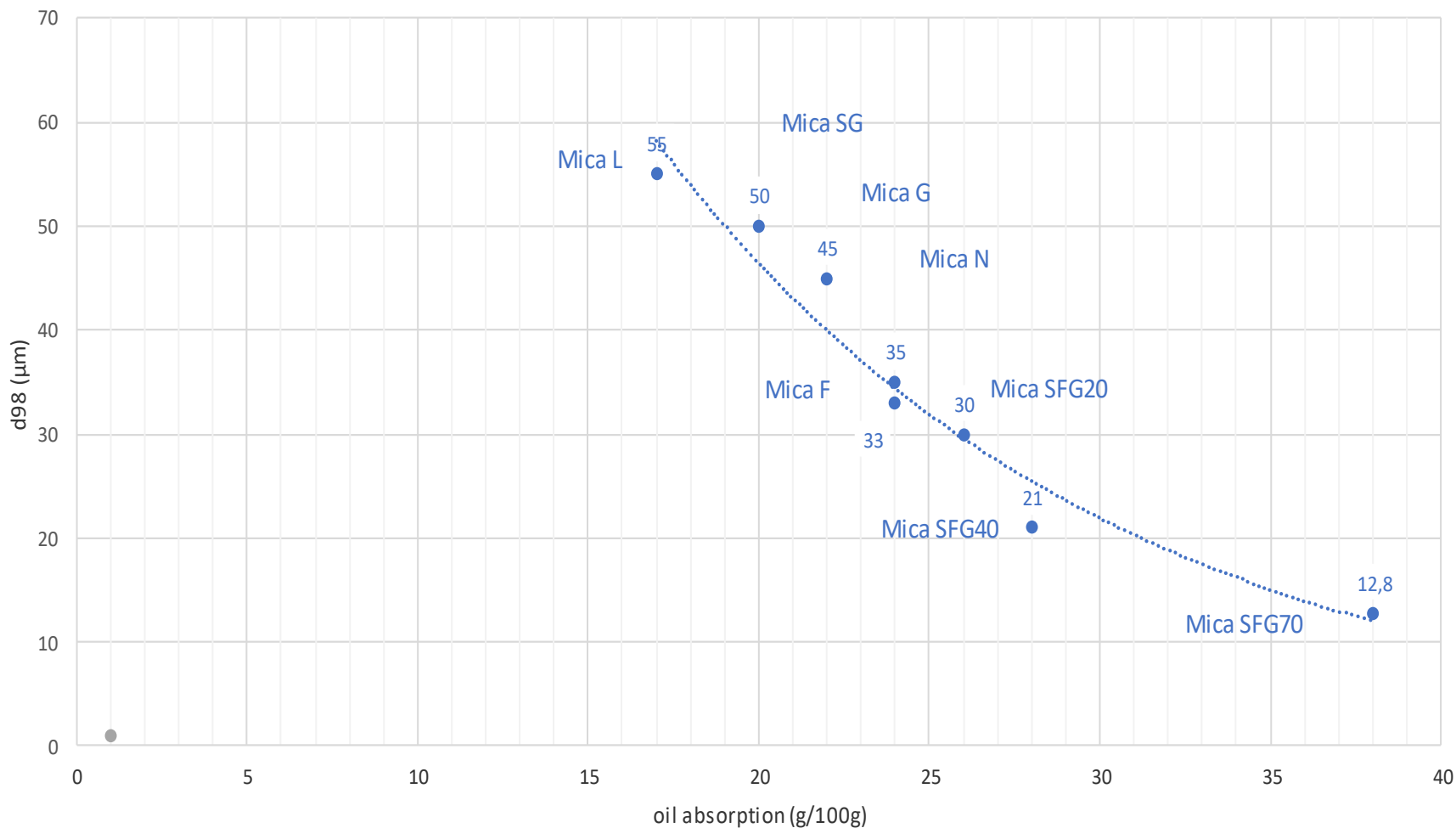




- Spherical filler
e.g. Calcium carbonate
- MICA + ASPOLIT A. R. 50 - 60



Oil absorption (ISO 787-5)



Color - L*-value comparison

| | L*-value |
|----------------------------------|-----------|
| Aspanger MICA F | 92 |
| | |
| Aspanger MICA N | 91 |
| | |
| Aspanger MICA L | 90 |
| | |
| Typical MICA competitor | 89 |
| | |
| Typical Kaolin competitor | 87 |
| | |
| Typical Talcum competitor | 93 |

Why MICA in Polymer business?

- 1.) Improves mechanical strength & stiffness (Charpy impact strength)
- 2.) Low electric conductivity – isolation effect
- 3.) Reduces cracking & shrinkage & overlapping
- 4.) Excellent wettability due to low oil absorption
- 5.) Barrier effect (oxygen transmission rate)
- 6.) Easy to recycle (natural filler)
- 7.) Improves heat resistance
- 8.) Reduces pinhole effect
- 9.) Low thermal conductivity
- 10.) Excellent UV, IR and chemical resistance



Executive Summary – Aspanger Polymer Projects

1. Mica is showing **higher viscosity** compared to Talc.
2. Significantly **better Charpy Impact Strength** for Mica compared to Talc.
3. Highly comparable tensile results for Mica and Talc.
4. Mica is **decreasing the Oxygen Transmission Rate** as well as the **Water Vapor Transmission Rate** compared to Talc due to the higher aspect ratio (**barrier effect**).
5. Mica is showing comparable technical functions compared to Glass Fiber – cost advantage and advantage of a natural filler compared to Glass Fiber.

Executive Summary – Aspanger Polymer Projects

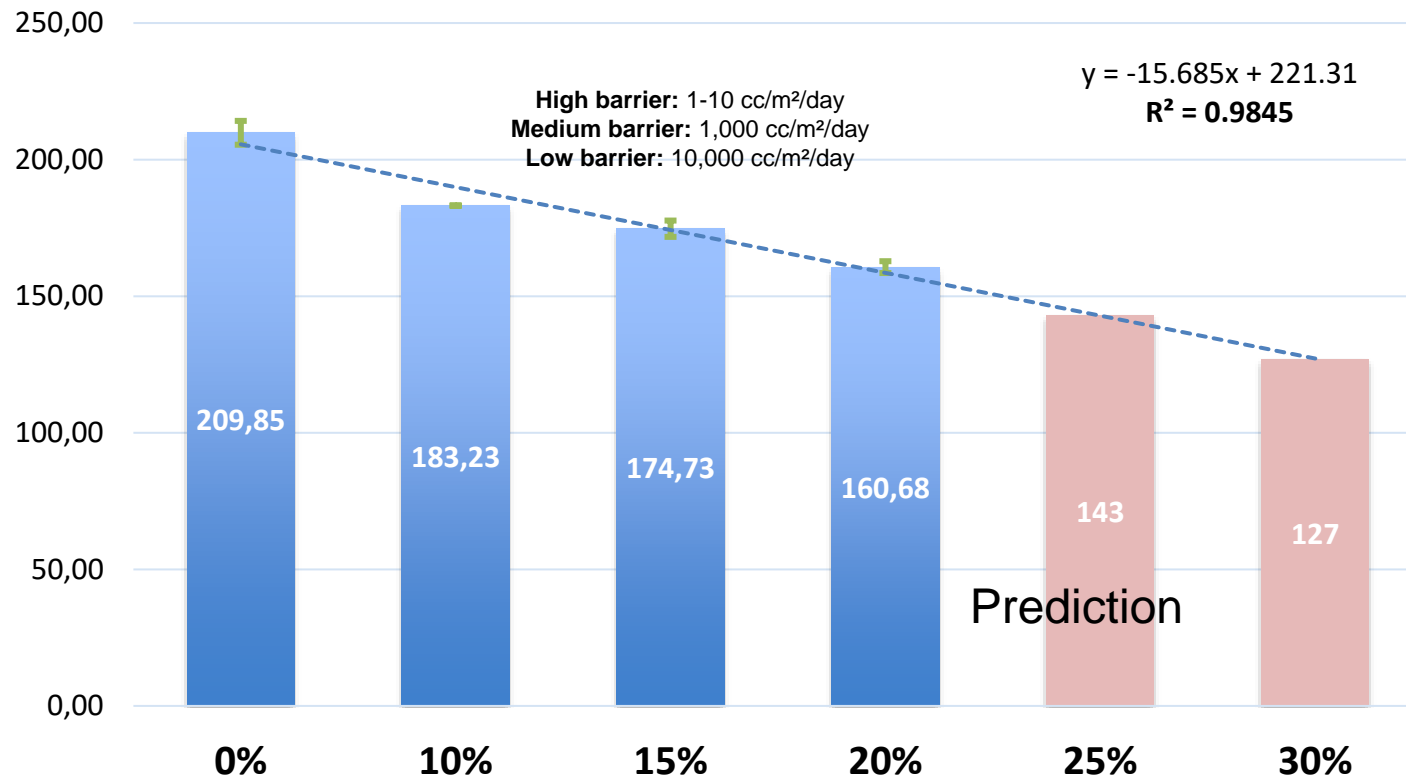
In the last couple of months, we made several tests to find out **why MICA should be able to replace Talcum in several polymer applications.**

Please find the **general advantages of using MICA compared to Talcum:**

- MICA has **twice the Aspect ratio** in powder from (1:60 for MICA compared to 1:30 for Talcum)
- MICA is **hydrophilic** – Talcum (surface) is hydrophobic
- MICA has in contrary to Talcum only **half of the oil absorption**
- MICA is 100% **free of asbestos** – in some cases there came up asbestos issues with Talcum (see Johnson & Johnson issue in US – chapter 11 Imerys US)

Example 1 for barrier effect:

Oxygen Transmission Rate [cm³/(m²*day)]



The lower the Oxygen Transmission Rate the higher the Mica content

Example 2 for barrier effect: Water Vapor Transmission Rate (WVTR)

| | Mica N | | Mica SFG 20 | |
|----------|-----------|-------------|-------------|-------------|
| | Sedigraph | Mastersizer | Sedigraph | Mastersizer |
| D50 (µm) | 4.6 | 10.5 | 3.8 | 9.5 |
| D98 (µm) | 18 | 36 | 14 | 30 |

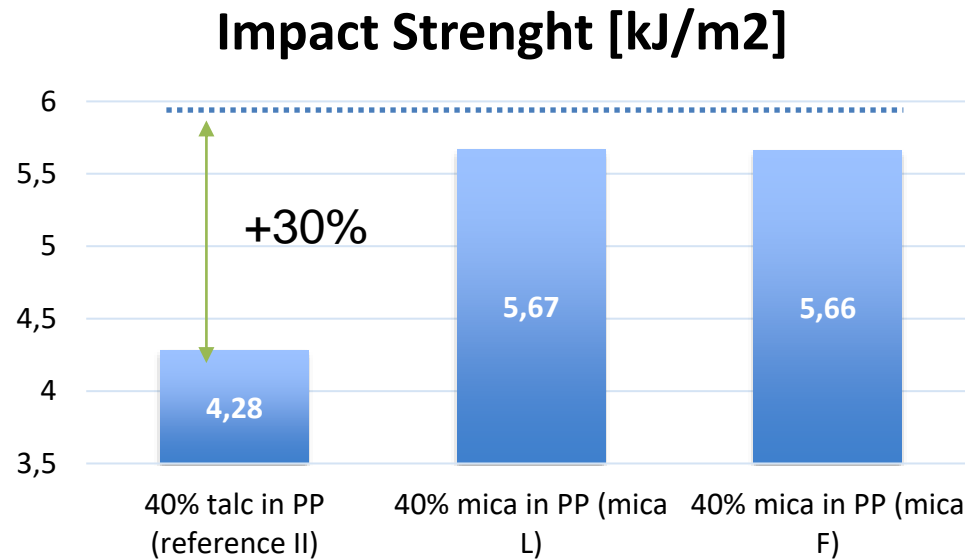
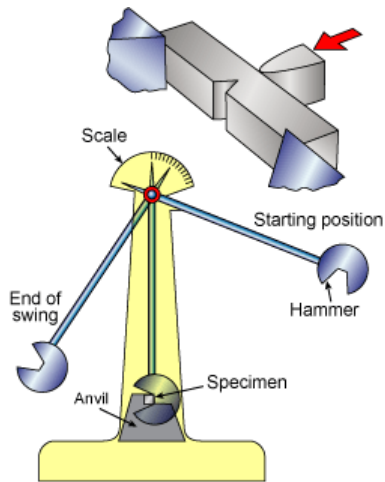
Reference: WVTR (100% PLA) = 102.6 g/m²/day

| WVTR | Mica N | Mica SFG20 |
|------------|--------|------------|
| 10% in PLA | 119.1 | 135.7 |
| 20% in PLA | 115.9 | 128.0 |
| 30% in PLA | 109.6 | 121.1 |

Values in g/m²/day

WVTR measured at 37.7 ° C

Charpy Impact Strength

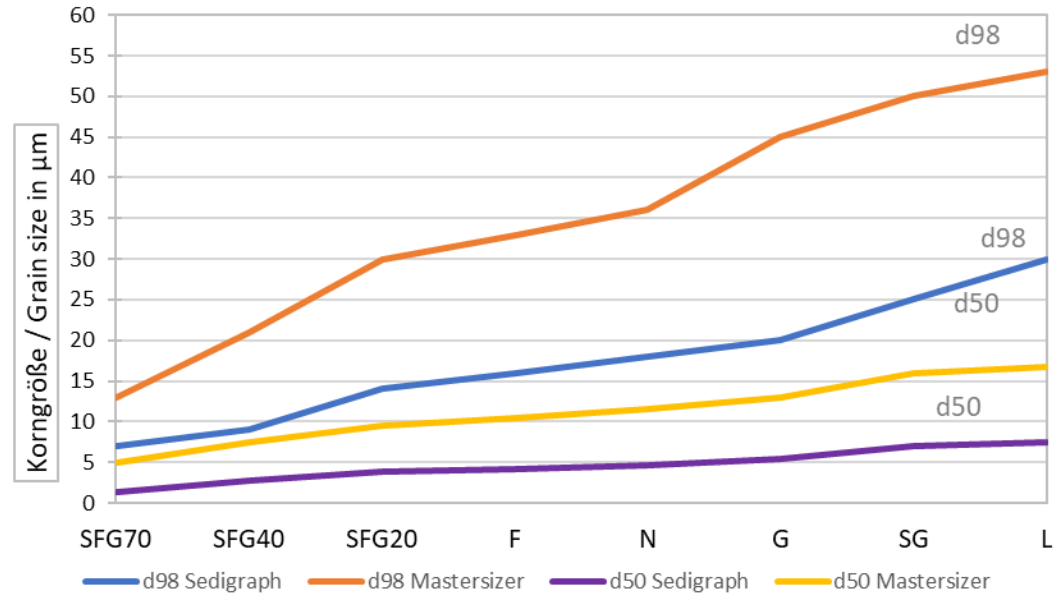


Higher impact strength for Mica samples compared to Talc (**appr. 15% higher** for 20% filled samples; **appr. 30% higher** for 40% filled samples)

MICA

- Density 2,85 g/cm³
- Mohs hardness 2,5
- Refractivity 1,56
- pH-value 9,5
- Moisture < 1%

Grain size

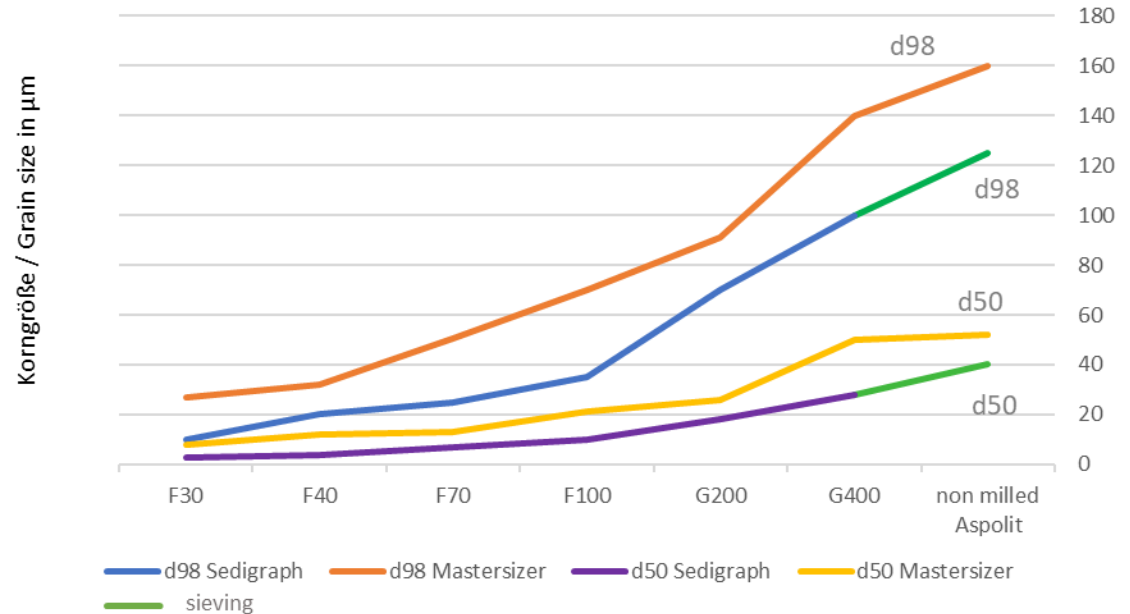


| Physical Data MICA | SFG70 | SFG40 | SFG20 | F | N | G | SG | L |
|--|--------|-----------|-----------|------------|------------|------------|---------|------------|
| Oil absorption (g/100g) | 38 | 28 | 26 | 24 | 24 | 22 | 20 | 17 |
| L* value (%) | 94 | 93 | 92 | 92 | 91 | 91 | 90 | 90 |
| Grain size D98 (µm) (Sedigraph/Mastersizer) | 7 / 13 | 9 / 21 | 14 / 30 | 16 / 33 | 18 / 36 | 20 / 45 | 25 / 50 | 30 / 53 |
| Grain size D50 (µm) (Sedigraph/Mastersizer) | 1,5/ 5 | 2,7 / 7,5 | 3,8 / 9,5 | 4,2 / 10,5 | 4,6 / 11,5 | 5,4 / 13,0 | 7 / 16 | 7,5 / 16,8 |

ASPOLIT

- Density 2,75 g/cm³
- Mohs hardness 2,5 Mica
7 Quartz
- pH-value 9,5
- Moisture < 1%

Grain size

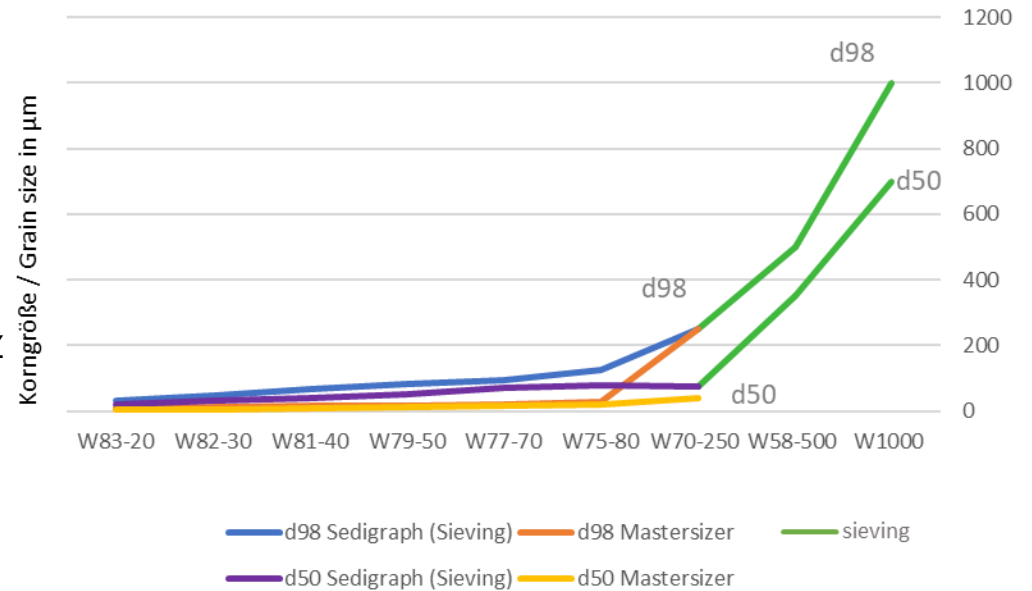


| Physical Data Aspolit | F30 | F40 | F70 | F100 | G200 | G400 | Non-milled Aspolit |
|--|-------|-------|-------|-------|-------|------------------------|-------------------------|
| Oil absorption (g/100g) | 22 | 21 | 20 | 17 | 13 | 12 | - |
| L*value (%) | 90 | 90 | 89 | 89 | 84 | 85 | 82 |
| Grain size D98 (µm) (Sedigraph/Mastersizer) | 10/27 | 20/34 | 25/50 | 35/70 | 70/95 | (sieving/MS) 90/155 | (sieving/MS) 125/160 |
| Grain size D50 (µm) (Sedigraph/Mastersizer) | 3/8 | 4/12 | 7/13 | 10/21 | 18/26 | (sieving/MS) 24/50 | (sieving/MS) 38/52 |

ASPOLIT-W

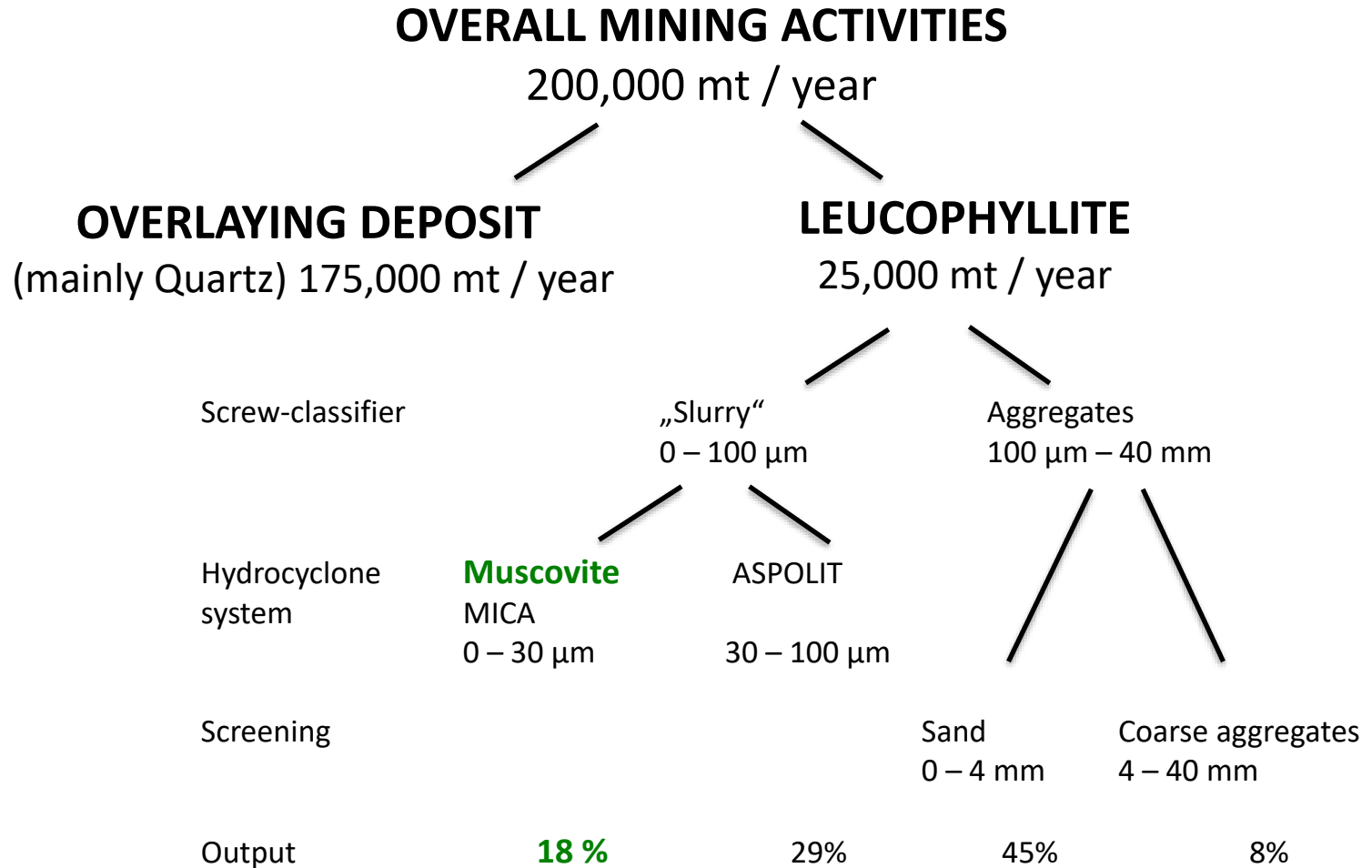
- Density 2,75 g/cm³
- Mohs hardness 2,5 Mica
7 Quartz
- pH-value 9,5
- Moisture < 1%

Grain size



| Physical Data Aspolit-W | W83-20 | W82-30 | W81-40 | W79-50 | W77-70 | W75-80 | W70-250 | W58-500 | W1000 |
|--|--------|--------|--------|--------|--------|--------|----------|---------|-------|
| Oil absorption (g/100g) | 21 | 20 | 18 | 15 | 13 | 13 | 11 | - | - |
| L* value(%) | 90 | 90 | 90 | 89 | 88 | 88 | 87 | | |
| Grain size D98 (µm) (Sedigraph/Mastersizer) | 20/30 | 30/48 | 40/67 | 50/83 | 70/93 | 80/126 | 250*/250 | 500* | 1000* |
| Grain size D50 (µm) (Sedigraph/Mastersizer) | 3/8 | 4/12 | 7/14 | 10/21 | 14/20 | 19/26 | 75*/40 | 350* | 700* |

4) ACTUAL PROCESSING OF ASPANGER MICA





Opencast
Mining



Wet
Processing

MICA, ASPOLIT, ASPOLIT-W, quartz sand



Dry
Processing

MICA, ASPOLIT,
ASPOLIT-W



Laboratory

Quality assurance

Advantages for Aspanger clients

- Quick & flexible service (**family owned & managed company**)
- **Product documentation based on clients requirements** done by Aspanger internal laboratory (XRD, Mastersizer PSD, Spectrophotometer, ...)
- If needed, even **microbiological & heavy metal analysis** (external laboratories)
- **You are welcome to visit Aspanger mining company personally!**

www.aspanger.com



Thank you for your attention!

Irina Gorodnyakova (c) 2019 @igorod photo

