A NATURAL EUROPEAN MICA PROVIDING SOFTNESS, COHESION AND LONG LASTING EFFECT

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THE HIDDEN DIVERSITY BEHIND THE INCI NAME 'MICA'

Mica minerals, particularly muscovite are widely used in the cosmetic industry. The mineralogical diversity of muscovite observed is mainly due to rock origin:

MAGMATIC

Pegmatites – Big crystals of mica

ORIGIN: Brazil, India, Madagascar

- Not abundant
- Pure mica

Granites – Little flakes of mica

ORIGIN: All continents

- Abundant
- Associated with other minerals

SEDIMENTARY

Sericite – Ultra fine mica

ORIGIN: China, Brazil, India, USA

- Abundant
- Associated with other minerals

Although the chemistry of muscovite is unchanged from one rock to another, mica crystals were not formed in the same conditions which can impact the properties in application.

The selection of an appropriate mica grade is therefore crucial for achieving the desired aesthetic, functional, and sustainability outcomes in personal care formulations.

This poster provides an overview of the different grades of mica available for cosmetic use in the market, examining their mineralogical characteristics, processing methods, and how these influence their performance in pressed powder formulations. This study explores how differences in mica type, morphology and surface chemistry as well as purification process can be leveraged in cosmetic product development and innovation.

MATERIALS & METHODS

MATERIALS

	Sericite 1	Sericite 2	Mica 1 (from granite)	Mica 2 (from granite)	Mica 3 (from pegmatite)
ORIGIN	China	USA	France	France	Brazil

METHODS

X-ray diffraction

Used to identify and quantify crystalline phases of mica and therefore, its purity.

A Cu X-ray source at a wavelength of 1.54A is used at angles from 3 to 65 degrees during 24.56 minutes.

Aspect ratio

This method uses conductivity and density. Particles are suspended and left to equilibrate, then separated using a centrifuge. Each dispersion is measured with a FiveEasy Plus FP30 conductivity meter according to the method described by *Weber et al. in Clay Minerals, (2014) 49, 17–26.*

Oil absorption

This corresponds to the quantity of linseed oil added to 1g of mineral to obtain a stiff, homogeneous, smooth paste. The oil absorption value (ml/100g) assesses a mineral's capacity to absorb oil and organic components. It is measured according to standard ISO 787-5:1980.

Formulation of pressed powder

Ingredients	Function	%
Muscovite base	**Cohesive agent**	**74.2**
Zinc stearate	Compacting agent	10.0
Iron oxides	Pigment	6.8
Dicaprylyl carbonate	Binder	7.2
Isostearyl Isostearate	Binder	1.8

Evaluation of sebum resistance

USkin™ technology is used to measure the shine of the skin before, during and after sebum secretion. 5mg of powder is applied on a skin model mimicking human skin. Sebum secretions are pulsed at regular intervals, representing 3.9µL. Gloss variation (ΔGloss) is expressed by the difference between gloss measured after 3 pulses (correlated with 24h in vivo secretion) versus gloss after 1 pulse. If ΔG is between -0.01 and 0.01, there is gloss control. If ΔG is above 0.01 it means there is a gloss increase that produces a shiny effect on the skin.

Evaluation of the cohesiveness of pressed powders

Cosmetic drop test equipment is an automatic equipment used to count how many drops the pressed powders can resist. This test is performed three times on three different pressed powders of the same composition.

Evaluation of sensory profile

A sensory analysis was conducted with 18 texture experts according to NF EN ISO 13299. Volunteers assessed the pressed powders according to different criteria on a scale of 0 to 10.

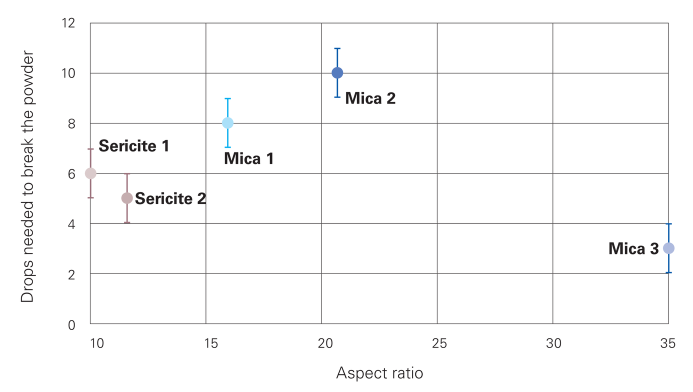
RESULTS & DISCUSSION

	Muscovite	Quartz %
Sericite 1	Main phase	<DL
Sericite 2	Main phase	<DL
Mica 1 (from granite)	Main phase	5
Mica 2 (from granite)	Main phase	<DL
Mica 3 (from pegmatite)	Main phase	<DL

XRD analysis confirms that whatever the origin, all the products have globally the same composition based on muscovite. The main difference is in the process used. Contrary to Mica 3 which is extracted at a high purity state, Sericites, Mica 1 and Mica 2 require process purification steps to obtain low level or absence of quartz.

(< Detection Limit)

Cohesion of the powder in relation with AR



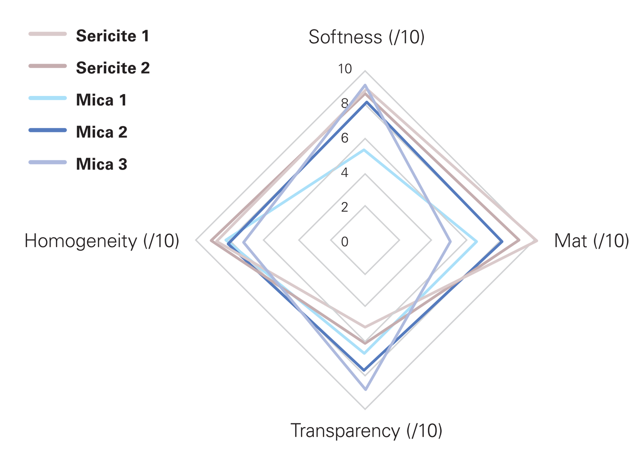
The aspect ratio of the particles has to be considered in order to optimize this cohesion performance. If the aspect ratio is too low (Sericites), cohesion cannot be guaranteed due to the small surface of particles which reduces cohesion between particles. However, a very high aspect ratio doesn't guarantee good drop resistance either. Indeed, as illustrated below, during compaction, there is a creation of bonds between hydrogen atoms of mica and oxygen atoms from binders such as esters (RCOOR') and from other micas. The multiplication of these hydrogen bonds help to the cohesion.

Mica 3, high aspect ratio — **Mica 2, medium aspect ratio**

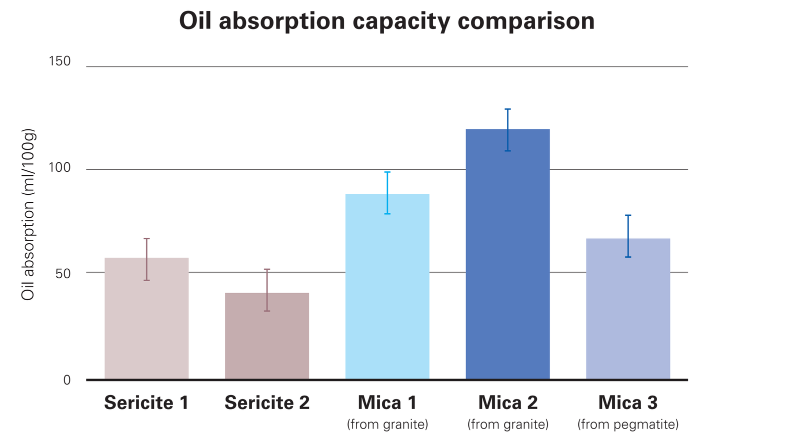
This panel test highlights that the sericite family is differentiated from other micas in terms of optical properties by an ultra mat effect and less transparency on the skin. It is noted that Mica 3 is the most shiny mica according to the panel.

With a Mohs hardness of 7, which corresponds to the hardness and the abrasivity of the material, the presence of quartz has a detrimental effect on the softness of the product (Mica 1 vs 2) – Mica has a Mohs hardness of 2.5. The importance of removing quartz trhough a mechanical process is therefore key.

Panel test evaluation on pressed powders

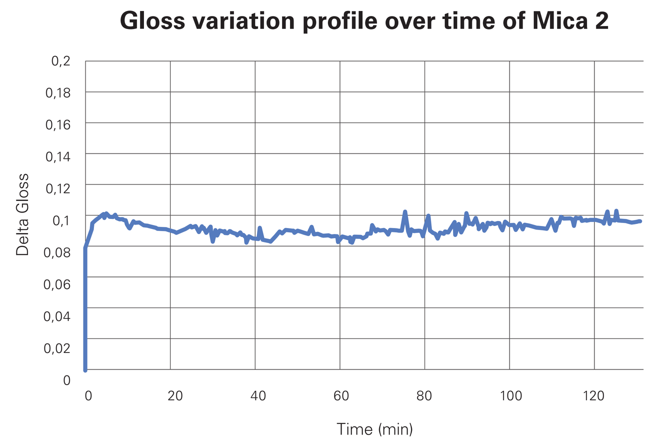


Oil absorption capacity comparison



The lefthand graph indicates superior oil absorption capacity for Mica 2. This is unconventional for a mica, and can provide gloss control as indicated in the graph of the right. Indeed, despite the addition of sebum secretion, there is no important variation in gloss over time. ΔGloss 24h = ΔGloss end 3rd pulse - ΔGloss end 1st pulse = -0.004 < 0,01.

Gloss variation profile over time of Mica 2



This result indicates that mica provides gloss control. Mica 2 allows control of skin mattness throughout the day, despite regular sebum secretion. Introduced at a high percentage in the pressed powder, this mica can guarantee a long-lasting effect of the make-up powder.

CONCLUSION

This study demonstrated that the mineralogical type and geological origin of the mica significantly influence its structural properties. Moreover, the manufacturing process directly affects its performance in pressed powder formulations.

This underscores the importance of adapting the selection of the mineral for cohesion performance and desired sensorial and optical outcomes.

French natural Mica 2 offers the best compromise as a mineral base powder for pressed powder by combining high cohesion, softness and long lasting effect.

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