Text Timo Hämäläinen, photos Miika Kainu and Kemira

New technology:

Customized pigments

New calcium sulfate crystallization technology developed by Kemira opens up the possibility of producing coating and filler pigments tailored to customers' specific processes – enabling producers to increase their efficiency and profitability.

The new calcium sulfate crystallization technology and product family developed by Kemira, together with a group of Finnish forest product companies and forest industry researchers, recently achieved the commercialization stage.

The technology enables calcium sulfate crystals to be produced in exactly the size and shape desired, in platy, needle, or rhombic shapes. Structured pigments have a very bright future ahead of them.

"Thanks to the new technology, we've been able to produce a product family offering the best solution for different customers'," says R&D Manager **Esko Aarni**.

The ultimate aim of the project, he explains, has been to offer customers new opportunities to reduce their costs, improve their paper machine runnability, and enhance the quality of their products.

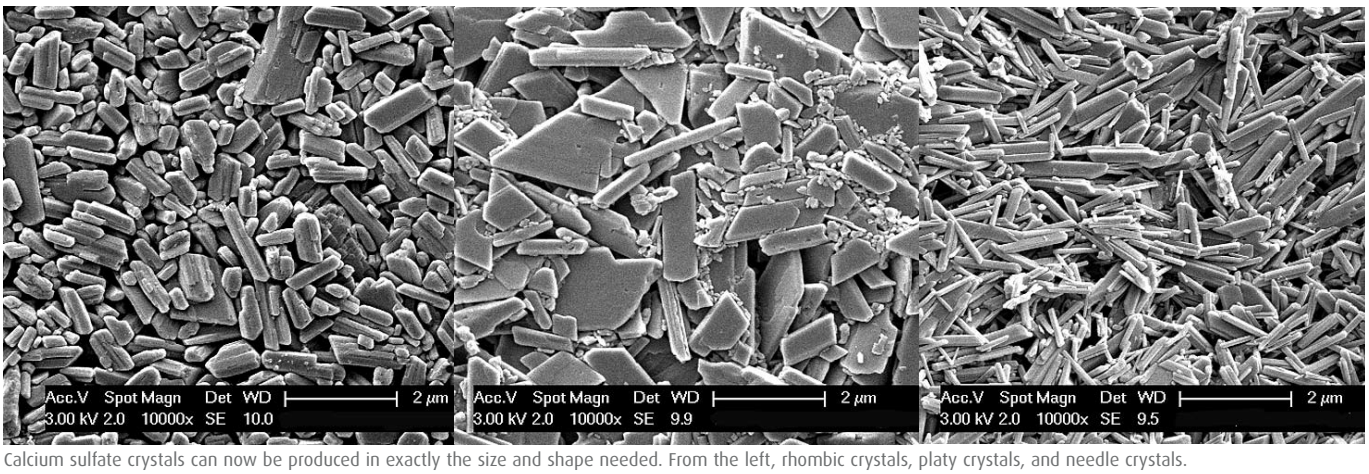
"By producing pigment particles within a narrow size distribution, we can improve the light scattering coefficient, and by selecting correct pigment morphology we can improve the paper gloss, for example. Needle-type crystals combine good gloss, light scattering, and coater runnability. In the case of filler applications, we're currently concentrating on platy like crystals and the benefits they can offer in terms of costs savings in different applications.

"During trial runs with customers, we've been able to demonstrate very consistently that calcium sulfate gives paper coating a high surface strength. Used as a filler, it offers high tensile strength. We've been able to increase filler content by as much as 5% over normal levels, while maintaining the desired level of tensile strength. This has the potential to offer major cost benefits in virtually any application."

High paper and print gloss

In paper coating applications, pigments with a very small particle size give good paper gloss during calendaring. As a result of the lower density of calcium sulfate, it is possible to achieve the same level of gloss but with bigger particle size and benefit from a more advantageous microstructure in coating layer; offset ink sets slower with calcium sulfate.

"When offset setting is slow, the ink tackyness in offset press also develops more slowly. This means that a coating does not need to offer the same tensile as in case of rapid ink set-



Calcium sulfate crystals can now be produced in exactly the size and shape needed. From the left, rhombic crystals, platy crystals, and needle crystals.

ting. On the other hand, due to bigger particle size calcium sulfate has a lower specific surface area compared to other pigments which also reduces the coating binder demand. This combination of slow ink setting and low specific surface area enables coating designers to control the ink setting speed in a very cost-effective way by reducing the binder level."

Less chemicals

Most visible cost savings and improvements in paper quality can be achieved in an acid paper making process by replacing kaolin with calcium sulfate.

"Calcium sulfate is also ideal for use in an acidic environment. Advantages like less fiber darkening and improved control of microbiological deposits reduce the chemical consumption when producing SC paper in acidic conditions. Brightness level will be improved significantly, thanks to the high brightness of typical platy shape filler pigment."

End-product porosity with platy shape calcium sulfate will remain essentially the same as with kaolin, says Aarni, and therefore porosity-related printability problems will not occur..

No technical issues

Although Kemira's new crystallization technology opens up new opportunities for using and producing calcium sulfate pigments, the company still plans to develop and extend its wet milling-based product range. The latest precoating pigment developed with this technology is currently being commercialized.

"We've already tested coatings where we've replaced kaolin with platy shape calcium sulfate, and carbonate with either needle shape or rhombic calcium sulfate, and produced a 100% gypsum coating. And the coater runnability has not been an issue either, this is ensured through our knowledge and expertise in dispersing calcium sulfate" says Aarni.

In practice, there are no technical barriers in using calcium sulfate as a filler or coating pigment.

"The high calcium content in process water has generally been seen as a risk. It's been assumed that a high calcium level will result in unwanted deposit issues and finally generating paper machine runnability problems. It's true that the calcium content of the water will increase, but there will not be any deposit problems. Kemira has put a lot of effort in understanding better the wet end phenomena in high calcium content and how to manage them. We always run wet end survey prior, during, and after starting the use of calcium sulfate." ■

"Thanks to the new technology, we can customize the best solution for a customer's process to save on costs and improve runnability and product quality," according to R&D Manager Esko Aarni, to the right, and Sales Manager Juha Kokko.

Kemira uses the by-product gypsum produced at Siilinjärvi phosphoric acid plant as the raw material for its calcium sulfate pigments.

Kemira to increase calcium sulfate pigment output

A new production line is due to be completed this spring at Siilinjärvi capable of producing 25,000 t/a of calcium sulfate pigment for use in paper filling and coating.

The expansion is based on Kemira's new crystallization technology, rather than wet milling, and will increase the site's overall capacity to 175,000 t/a.

The new production line will enable Kemira to meet the projected growth in the use of mineral pigments as the value-added aspect of paper products rises. Global demand is expected to increase by around 3%/a over the next 10 years, with the use of calcium sulfate pigments, both in filler and coating applications, rising many times over.

Pigments from by-products

Kemira's new calcium sulfate crystallization technology can make use of industrial by-products for its raw material input – enabling pigment products to be produced close to a paper mill.

Kemira has produced and supplied calcium sulfate pigments for coating and filler applications for more than 20 years. Up until now, however, production has been based on wet milling, and products have been supplied as slurries, something that has slowed their widespread adoption.

With the new technology, Kemira can now serve customers that are located a long way from where its pigments are produced. Calcium sulfate pigments can be supplied from Finland in powder form to a satellite production unit for finishing and onward delivery to the customer – or pigment production can take place locally if the right raw materials are available.

"We've tested calcium sulfate pigments in the other Nordic countries, Central Europe, and North America with both uncoated and coated paper grades – and we've got plans in place to begin pigment production close to our customers in all of these regions," according to Sales Manager **Juha Kokko**.

"As the gypsum we use as our raw material is available in all of these regions, we'll be able to supply our customers cost-effectively, thanks to our efficient supply chain and network of local partners."

Kemira has a number of projects under way aimed at investigating the feasibility of using the gypsum produced as a by-product by flue gases at power plants as a raw material for its pigments.

"This gypsum is potentially a perfect raw material for us, as long as it meets certain criteria, and these can normally be achieved with a minimum of work," says Kokko.

Kemira has not used this type of gypsum in Finland, however, as more than enough gypsum is available as a by-product from the phosphoric acid plant at Siilinjärvi.