



CaCO₃: synthetic but effective

20 February 2009

Recycled lime waste finds new life in CalciTech's coating-grade synthetic calcium carbonate

Headquartered in Geneva, Switzerland, public company CalciTech Ltd has developed revolutionary technology for the conversion of waste industrial lime into high quality synthetic calcium carbonate (SCC).

CalciTech describes its SCC as a next generation white mineral, providing “significant technical improvement” in a number of applications – namely high brightness paper coatings and quicker paper drying – compared with precipitated calcium carbonate (PCC) and ground calcium carbonate (GCC).

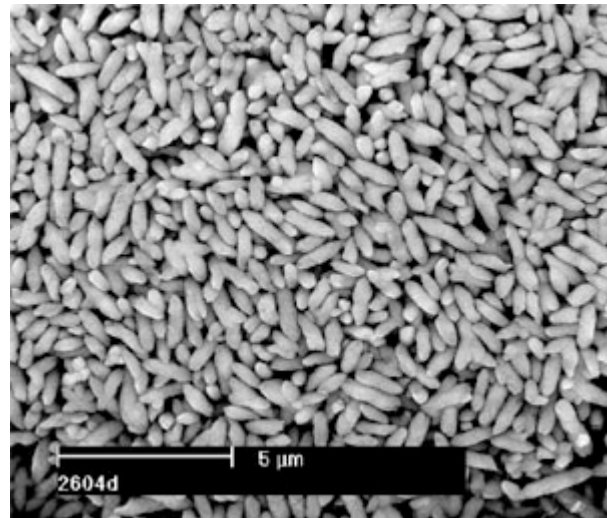
The company is attempting to bring its SCC into commercial production with a global growth strategy that utilises

CalciTech's unique process of fabricating, what it describes as “exceptionally pure”, SCC from low grade raw materials. Using this proprietary process the company states that it can produce globally consistent specifications.

If possible, this would be beneficial for existing PCC and GCC consumers, whose material is largely dependent on the quality of each mineral deposit they source from; these processing routes have limited scope for chemical beneficiation and removal of impurities.

Production

The development of SCC relies on the preferential solution of calcium hydroxide (Ca[OH]₂, or *slaked lime*) entering the reactor vessel as a filtered, clear liquid, to react



SEM image of CalciTech's SCC mineral grade, showing typical rice-shaped structure. Scale bar is at 5µ. Courtesy CalciTech Ltd

with waste carbon dioxide. Impurities and large particulate contaminants are removed prior to CaCO₃ formation.

CalciTech claims that, in addition, the company’s solution carbonation reaction is “much faster and more controllable” than normal PCC precipitation, which allows particle size and shape to be manipulated – something not possible with existing commercial processes.

Using this recycling process, the company has produced a range of SCC products with features such as high brightness, narrow particle size distribution (PSD) and a unique grain morphology, which comprises individual crystallites bound together to form a rice-shaped particle.

The company stressed that although the SCC process can be used to produce a wide range of particle sizes, CalciTech has initially developed products with a mean particle size of 0.9µ. These products are available on a pilot scale with differing purity specifications and product forms.

Grades

CalciLS is an SCC grade designed to provide high brightness and opacity for coated paper. Further, the company claims that the narrow PSD of CalciLS can aid the paper drying process, while an absence of large particulate contaminants reduces abrasion.

CalciRC 100S is a dried, stearic acid-coated version of SCC, primarily developed for use in polymers and sealants. In PVC window frames, the high purity leads to increased profile whiteness and thermal stability, while the tight top cut and easily dispersed particles result in significantly higher gloss compared to ultra fine GCC products.

The narrow PSD of CalciRC is also claimed to result in a better balance of performance (ie. of colour, gloss and mechanical strength) versus process rheology (gelation and melt viscosity). Essentially, this balance enables a higher filler loading than is usually possible.

A similar situation is true in sealants and adhesives, where CalciRC widens formulation flexibility, promoting the extension of expensive resins without compromising mechanical and rheological performance (*see table*).

Physical properties of CalciPR

CalciPR	
Purity (CaCO ₃)	>99.5%
Brightness (ISO)	1
Mean particle size	0.9 µm
Top cut (D98)	2 µm
Aluminium	< 10 ppm
Lead	< 0.2 ppm
Chromium	< 1.6 ppm
Mercury	< 0.02 ppm
Iron	< 20 ppm

Source: CalciTech Ltd

Meanwhile, CalciPR is suitable for use in industrial applications which are sensitive to impurities. In food contact inks, the rigorously

controlled number of large particulate impurities is claimed to be a key benefit. A guaranteed iron content of <20 ppm is an advantage in the production of special glass products (ie. ultra-clear, ophthalmic and new solar panels).

CalciSP is an equivalent grade produced to GMP specifications, designed for food and pharmaceutical applications.

Environmental benefits

Improved sustainability, in particular a reduction in carbon dioxide emissions, is important in industries where there is a short value chain, a short product lifetime or where greener competing technologies are emerging. These industries include those using paints, industrial inks and polymer-based packaging.

An ideal way to reduce total emissions, where possible, is to increase the use of mineral fillers, thereby extending more of the oil-derived polymers. This is already the case with GCC (emissions approximately 100kg CO₂/tonne of product) which can be added to polyolefin film (emissions approximately 2,000kg CO₂/tonne of product), with the aim of reducing the product's carbon footprint.

With SCC, this environmental benefit is claimed to be heightened, as CalciTech's process has a "negative carbon footprint" and uses waste burnt lime as the raw material source. Here, the CO₂ absorbed during the manufacture of SCC can offset emissions from production of the polymer. This is also the case when SCC is used in preference to other mineral fillers that can be used to extend TiO₂ pigment in paints.

Future development

CalciTech is presently implementing a global strategy with specific projects to commercialise its SCC technology, including a production plant at Leuna, Germany, planned to come on-stream in 2010. The company is also developing a number of joint-ventures to serve other regions, specialised industrial markets and global customers who require a consistent raw material which is available globally.

CalciTech's product development plans will focus on the flexible SCC process to manufacture a range of particle sizes and morphologies which are not commercially possible with either GCC or PCC.