

## Ceramic and powder engineering

**Processing of ceramic powders and solids puts high demands on raw materials and production processes in order to obtain optimum product properties. The RMS Foundation offers services and consulting in the field of ceramic and powder engineering. In addition to established analytical methods, the RMS staff has extensive experience in production and in research and development of ceramic materials, which allows to find customer-specific solutions for product-specific questions.**

Ceramic materials are usually more difficult to process than metals and plastics due to their inherent brittleness, hardness, and high thermal stability. But for the very same properties they are preferred in applications where high surface hardness, high thermal stability, high corrosion resistance, or low friction coefficients are required. In order to reduce the challenging mechanical shaping processes to a minimum, ceramic objects are often prepared as powders and pressed or cast into shape. A subsequent thermal treatment at temperatures sometimes far above 1000 °C can be applied to further densify and harden the material. This kind of processing puts high demands on physical and chemical properties of the precursor materials and on the production processes in order to obtain precise shapes and optimum mechanical properties. The RMS Foundation employs a team of scientists and engineers with many years of experience in production, characterization, and processing of ceramic materials. The group "Skeletal Substitute

Materials" has specialized on calcium phosphate ceramics, which are used for the production of synthetic bone implants due to their similarity to natural bone. The group has access to a multitude of analytical test methods to produce and characterize raw materials and products. A number of mills, mixing devices and furnaces are available for further processing of precursor materials and prototypes. Besides the various analytical test methods available at the RMS Foundation, several tests for ceramics and powders, and specifically for medical devices, have been implemented over the past years. This includes the analysis of reaction kinetics of cement pastes, identification and quantification of crystalline phases, as well as tests for



Figure 1: Calcium phosphate raw material is being taken out of the furnace at 1250 °C for quenching.

particle size distribution and specific surface area.

Our clients also benefit from extensive knowledge and experience of our team in the fields of material and functional tests, production processes, and registration of medical devices.



Figure 2: The particle size distribution is determined by sieve analysis.

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### Our equipment for powder production

- Clean room ISO class 7 (ISO 14644-1)
- Several high-temperature sinter furnaces (Tmax = 1600 °C)
- Several drying ovens (Tmax = 250 °C), with and without vacuum
- Jaw crusher, planetary mill, crown wheel mill, ball mill
- Turbula mixer
- Sieving machine with mesh sizes between 32 µm and 5.6 mm
- Precision balances (d = ± 0.02 mg)
- Centrifuge (Rmax = 4000 rpm)

### Selected analytical methods

- Microcalorimetry
- Loss on drying according to Ph Eur 6 Monography 2.2.32
- Loss on ignition according to ASTM D7348
- Quantification of crystalline phases, e.g. according to ASTM F1088
- Setting time of cements according to ASTM F451
- Specific surface area (BET-Model)
- Quantification of degradation products according to ISO 10993-14
- Particle size analysis by sieving
- Scanning electron microscope with EDX detector
- Porosity and density measurements

**Please discuss with us! We will be happy to advise you.**

**Or ask for our service catalogue. These and other information are also on our website.**

The RMS has been certified according to ISO 9001:2008. Selected services have been accredited according to ISO 17025.