Technology offer

Process Technology for Solution Precipitation of Nanocrystalline Materials

Description

Particle size reduction currently receives rapidly growing attention from all industry sectors since it allows to derive interesting material properties from simple and proven chemical compositions. Wet precipitations are well-known and thus attractive synthetic reactions but classical reactor concepts are often unsuitable for nanoparticle precipitation because of slow reactant mixing. Instead, highly elaborated ways of crystal growth and aggregation control are demanded. Until now, only few precipitation reactions could be transferred from laboratory to production plant, and all of them require considerable engineering efforts.

According to a novel precipitation technology, finely dispersed solid particles having sizes down to the nano-scale can now be industrially manufactured. Two reactants are separated in different compartments of a largely unpressurised membrane reactor while mass transport takes place by diffusion of one reactant through the membrane pores. The method is universally applicable, i.e. not confined to a specific reaction, and different kinds of industrial membrane modules can be used. Through specific selection of the membrane composition the process can be implemented under continuous operation without detrimental plugging. Additionally, sample preparations of CaCO₃ nanocrystals thus obtained exhibit large porosities which suggest novel applications as absorptive or carrier materials.

Application

Medium to large-scale preparation of (primarily inorganic) micro- and nanocrystalline powders.

Advantages

- Low-complexity apparatus construction made entirely of standard components; easily up-scalable at low investment and operating costs
- Stable process; keeps maintenance to a minimum due to reduced risk of clogging and avoidance of severe mechanical loads
- Allows to use homogeneous reaction media without additional phase modifiers
- Controllable particle growth via partial product recirculation; generates particles of high purity and uniform morphology

Status of development

- Technological demonstration on the gram scale using technical equipment, predominantly with Ca(OH)₂/CO₂ as a model workhorse
- Electron microscopic characterisation of product size and size distribution, crystal structure, pore volume, and specific surface
- Investigations into influence of reaction parameters on product properties

Patent situation

German priority patent.

Rights available

Joint development with out-licensing option.

Additional information

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