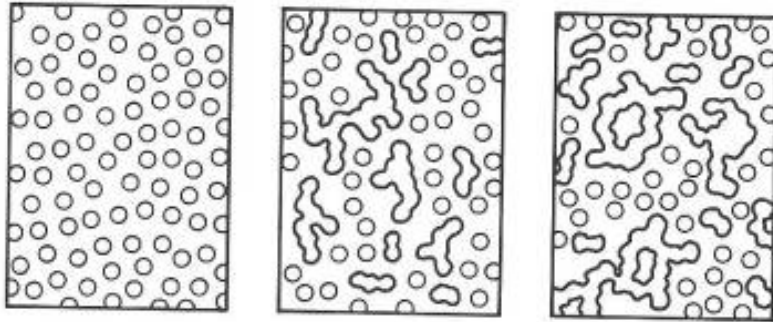
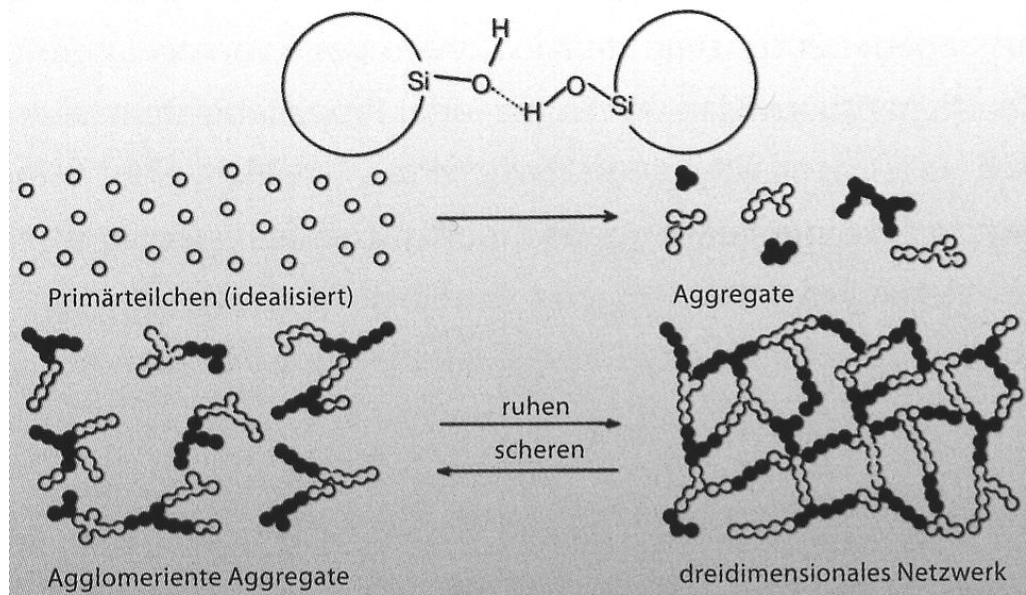
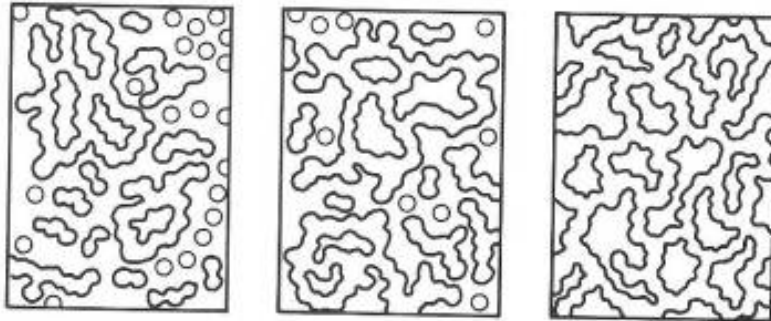


V Sol-Gel Process



Formation of a 3D network during gelation



Aggregats, agglomerates and networks

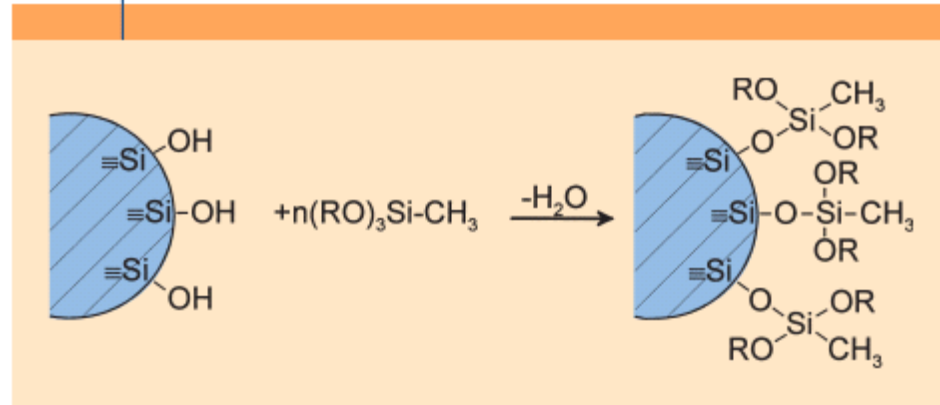
Aggregates: irreversibel

Agglomerates: reversibel

Network: labile

Sol-Gel Process: Stabilization of Sols

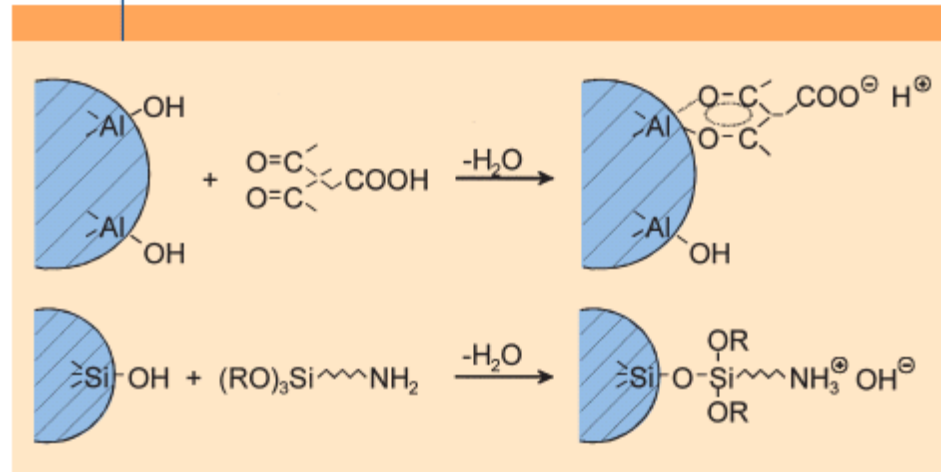
ABB. 5 | MODIFIZIERUNG VON SOL-TEILCHEN



Prinzip der Oberflächenmodifizierung von SiO_2 -Partikeln mit inerten Gruppen über Silanisierung.

Surface modification of sol particles to prevent condensation/gelation

ABB. 6 | ANBINDUNG GELADENER TEILCHEN

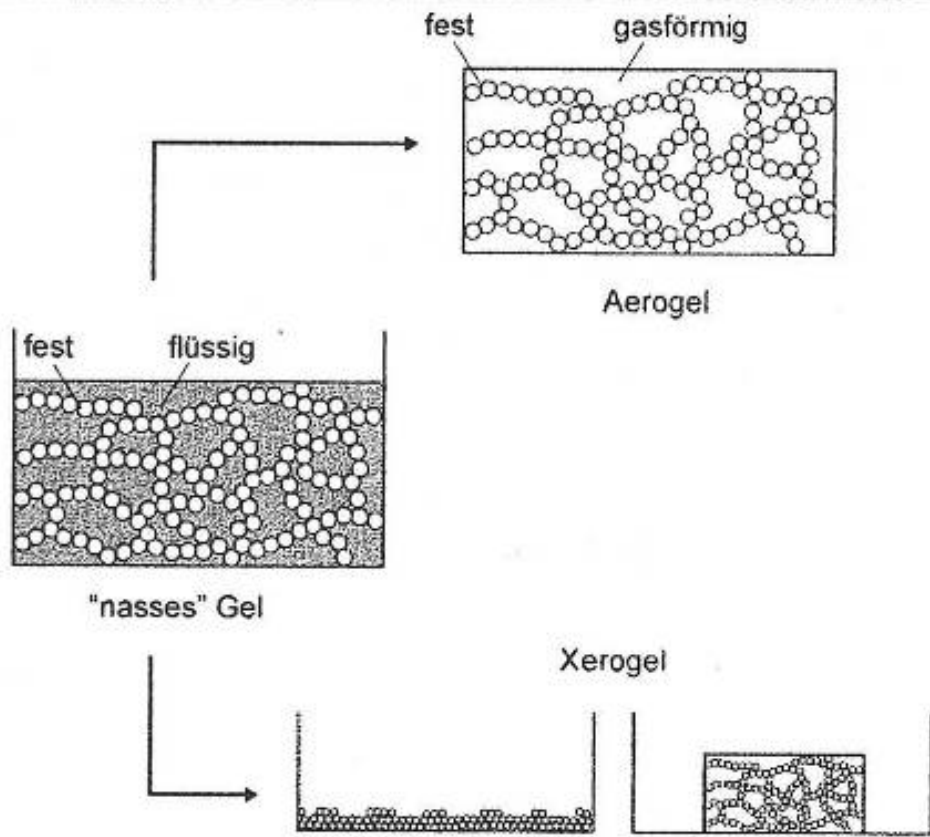


Elektrosterische Stabilisierung am Beispiel der Ankopplung einer Säuregruppe über Komplexbildung und einer Silanisierung mit Ammosilanen auf Nanopartikeloberflächen.

Surface inertisation and electrostatic stabilization

- allows higher solids content in a sol
- enhances shelf life (stability) of a sol

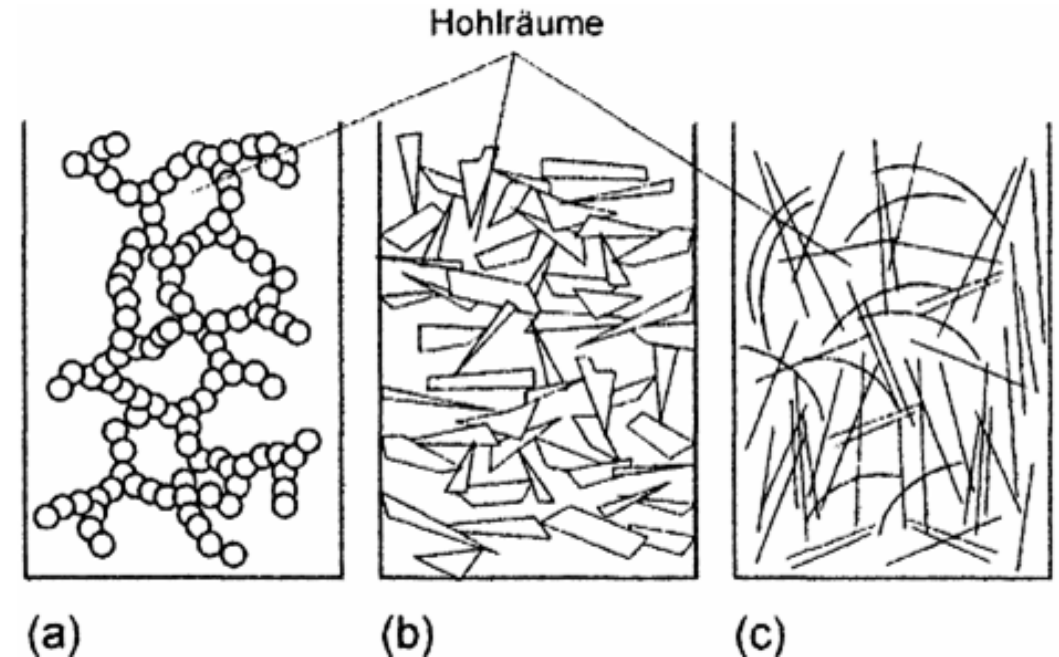
Sol-Gel Process: Xerogel and Aerogel



Xerogel/ Aerogel

Xerogel: evaporation of solvent causes
Shrinkage or collapse of 3D network in sol

Aerogel: careful removal of solvent under keeping of 3D network
(supercritical CO₂)



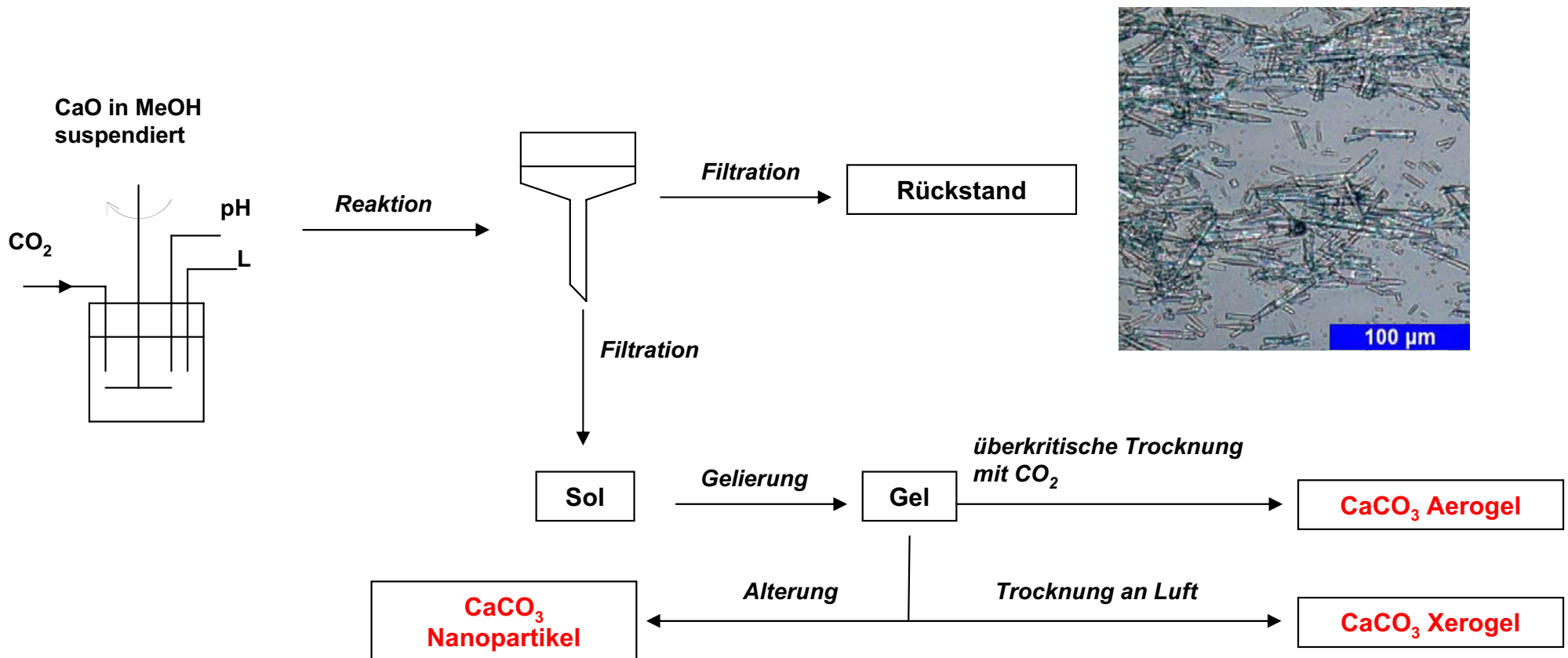
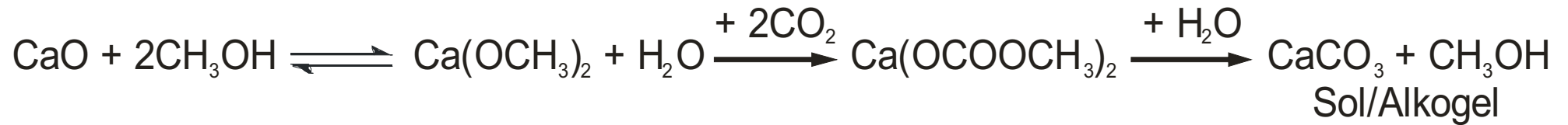
Relationship between particle geometry and gel structure:

- a) Spherical network structure
- b) Platelet structure
- c) Fibrous structure of gel

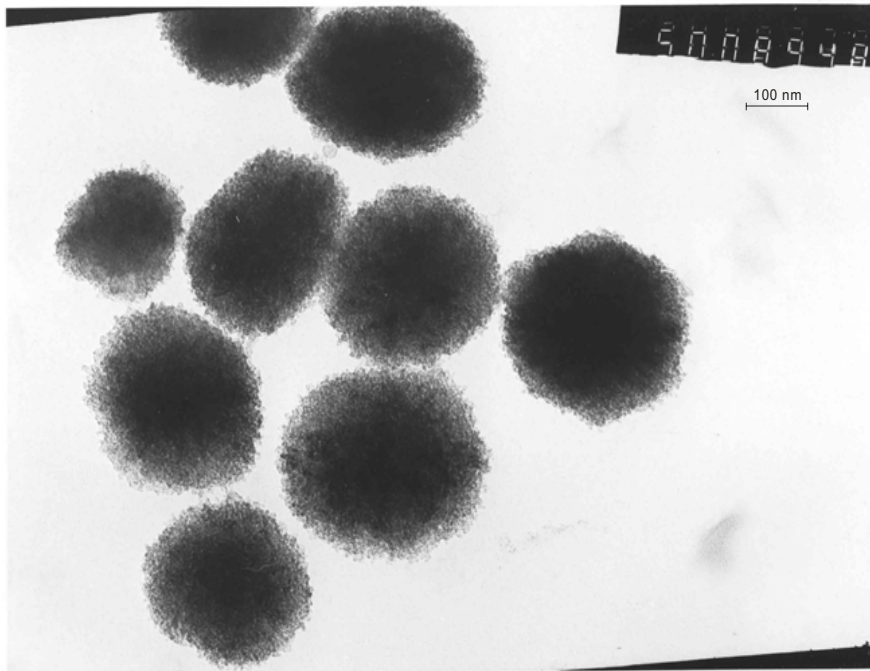
Sol-Gel Process: Preparation of CaCO_3 Nano Particles, Xerogel and Aerogel

CaCO_3 aerogel, CaCO_3 xerogel and CaCO_3 nano particles from sol-gel transformation of calcium di(methylcarbonate)

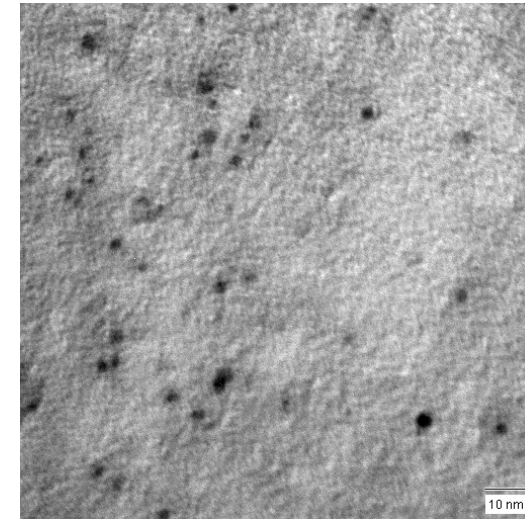
Reaction scheme:



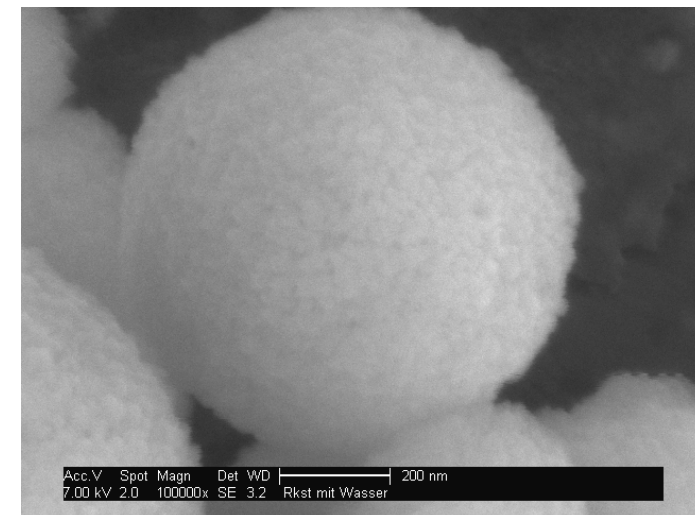
Sol-Gel Process: CaCO_3 Nano Particles



TEM image of CaCO_3
nano particles



Primary CaCO_3 nano
particles ($\varnothing$ 1-5 nm!)



SEM image of 500 nm
 CaCO_3 nano particles

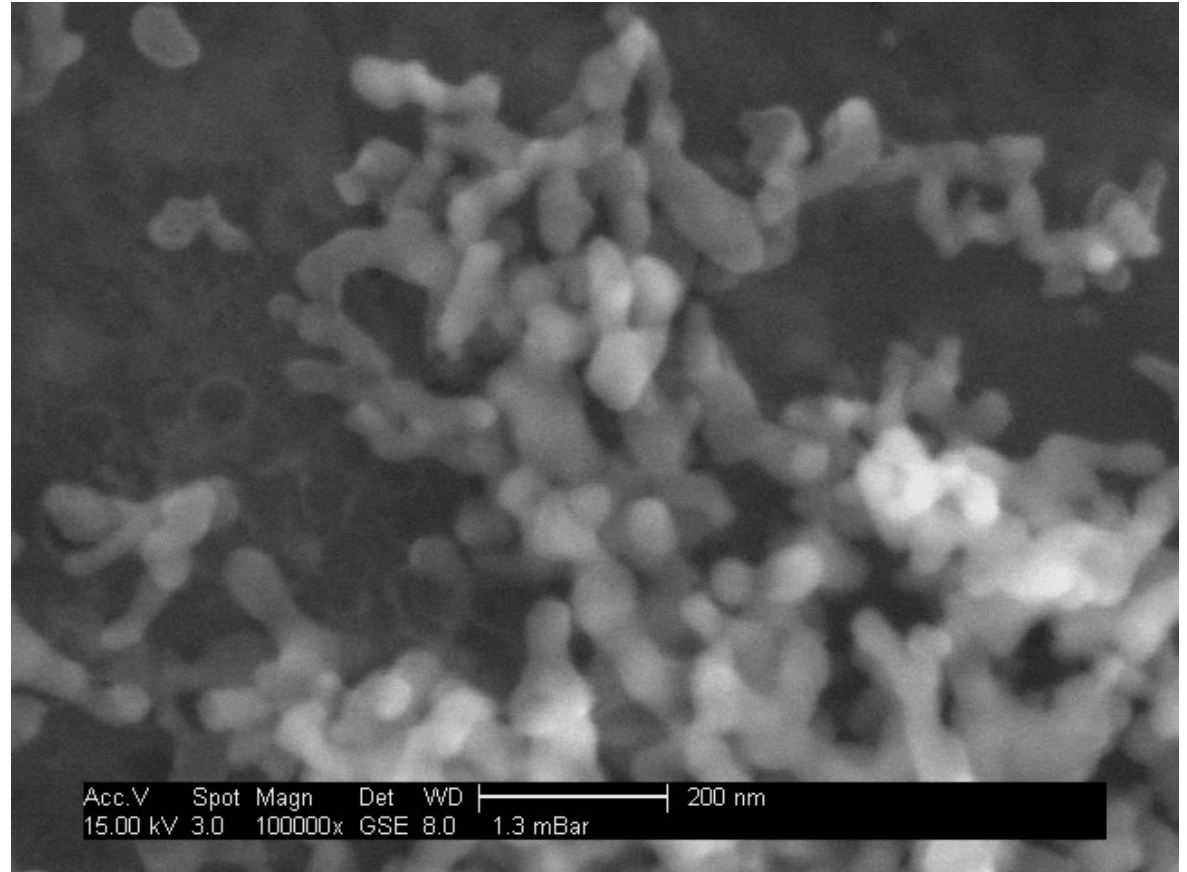
Sol-Gel Process: CaCO_3 Alkogel and Aerogel



CaCO_3 Alkogel

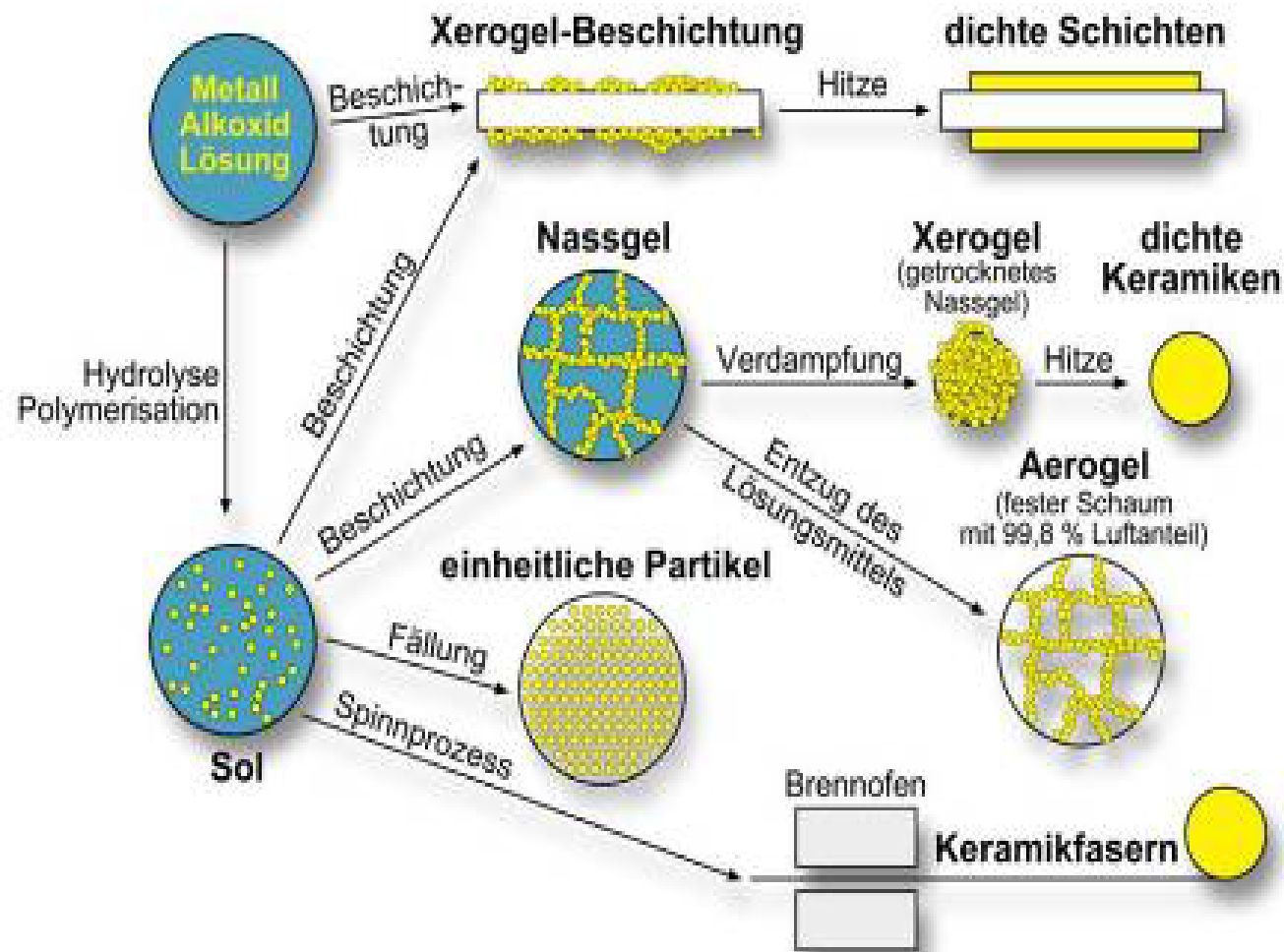


CaCO_3 Aerogel obtained
from supercritical drying



ESEM image of a CaCO_3 Aerogel

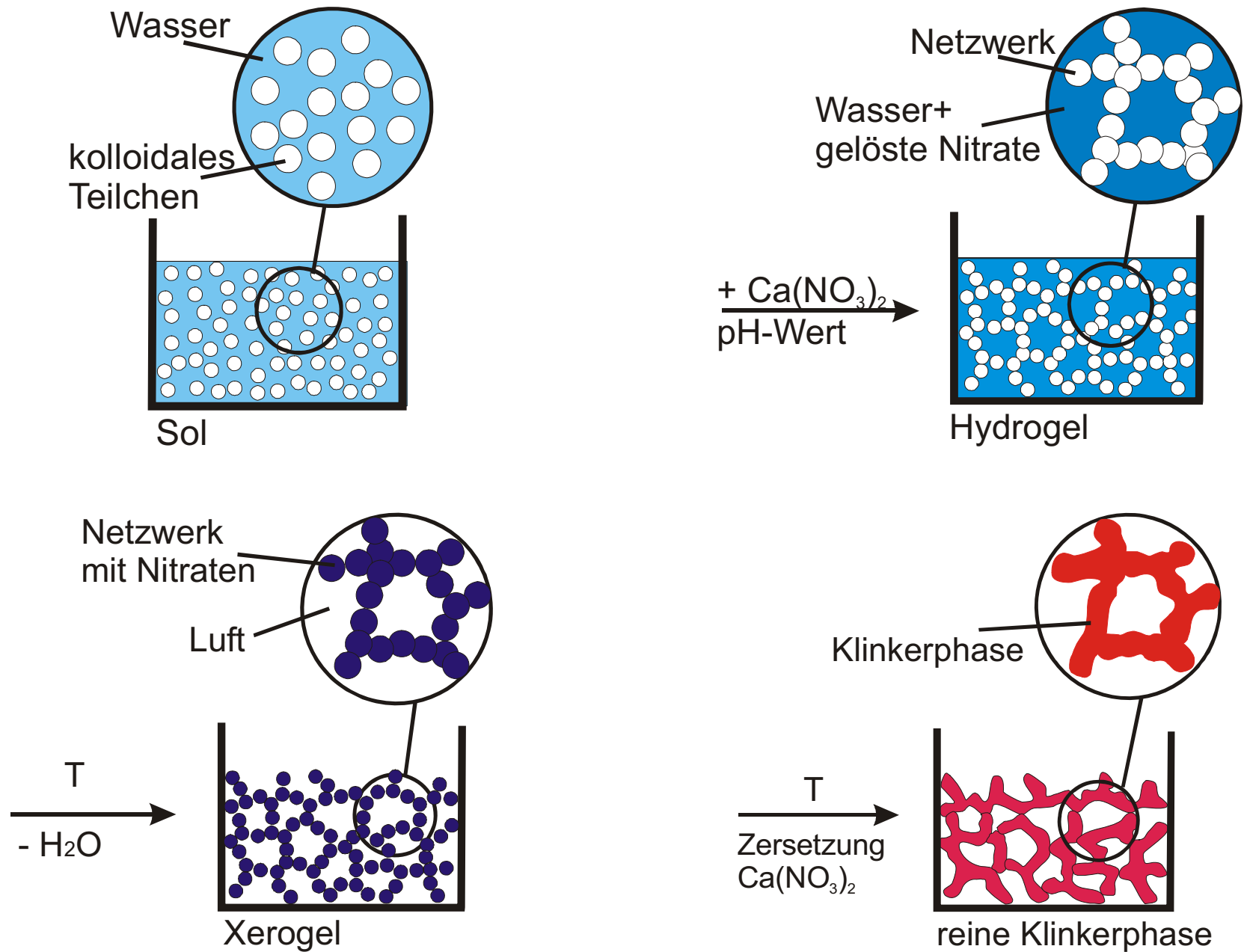
Sol-Gel Process: Nanos, Xerogels, Aerogels, Ceramics



Ceramic Coatings, Bodies and Fibers:

Application of a xerogel, followed by solvent evaporation and calcination

Sol-Gel Process: Preparation of Cement Clinker Phases



Sol-Gel Process: Industrial Applications

inorganic coatings

- reactive oxides (e.g. manufacture of pure cement clinker phases)
- ceramic materials
- ceramic coatings on temperature sensitive surfaces
- glasses
- manufacture of silica gels (adsorbents, chromatography, substrate for catalysts etc.)

→ In solid state reactions, the sol-gel process ensures high homogeneity and small particle sizes