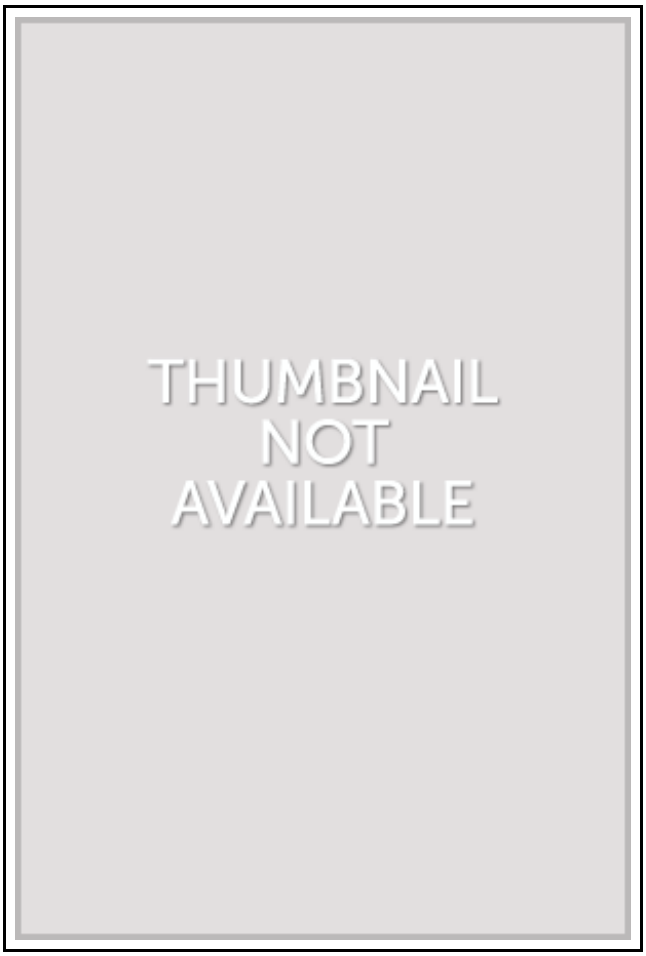
Mechanical Production of Nanoparticles in Stirred Media Mills



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MECHANICAL PRODUCTION OF NANOPARTICLES IN STIRRED MEDIA MILLS

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Cuvillier Verlag Jun 2007, 2007. Taschenbuch. Book Condition: Neu. 211x147x14 mm. Neuware - Nanotechnology applications in the pharmaceutical, materials, and chemical industries has renewed interest in the use of wet grinding in stirred media mills for the production of nanoparticles with controlled microstructure. Quite recently it is possible to mill particles down to the size range of 10 nm. However, challenges arise in the production of sub-micron particles that are, in part, due to colloidal surface forces influencing slurry stability and rheology. In this work experiments are performed on a well characterized model system of monodisperse primary nanoparticles that are salt destabilized and aggregated under various milling conditions. Perikinetic and orthokinetic aggregation are measured, with the latter in a laminar shear flow as well as in a stirred media mill, to examine the effects of colloidal stability and flow on the aggregation process. The agglomeration kinetics are measured using dynamic light scattering (DLS) as a function of electrolyte concentrations. Further information on the agglomeration process and the structure of the agglomerates are also obtained from small angle neutron scattering (SANS) and rheo-optical light scattering (ROA) experiments both at rest and under flow. Theoretical predictions for the colloidal stability from independently measured particle and solution properties compare well with the experimental results. Orthokinetic aggregation is observed to result in faster aggregation and denser agglomerates. Because of the high industrial demand for nanoparticles in organic media the study was extended to non-aqueous systems. Electrostatic stabilization requires a sufficiently high surface charge leading to a steeply decaying surface potential. These conditions can be met by solvents of medium dielectric constant (i.e. values larger than about 15-20), e.g. alcohols. In these media the particles may carry a high surface charge and the solubility of salts will be sufficient to enable a high repulsive barrier....

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