Shaping without touching:
ZnO nanoparticle production in miniemulsions

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Introduction

Influencing the nanoparticle *size* has been the most important issue in all nanomaterial-based applications [1]. Influencing the final *shape* of nanoparticles is nowadays of equal importance as shape relates to particular surfaces, to surface ratios and to applicable surface area. Creating particular active surfaces on a nanoparticle is the most influential aspect in applications like catalysis. The development of shape-specific nanoparticle production processes is therefore crucial to gain insight and control over the surface-related properties of nanomaterial.

Method and Results

Here we present a new miniemulsion-based process for ZnO nanoparticle precipitation where *technical* process parameters are used to influence the size and shape of the final ZnO nanoparticles [2]. Water, n-decane and the surfactant Span20 are the three components of a miniemulsion with average droplet sizes of around 200nm. Triethylamine and Zinc acetate dihydrate are the precursors for the ZnO nanoparticles. A one-miniemulsion technique was employed to obtain ZnO nanoparticles of about 50-100 nm in size with hexagonal shape and length-to-diameter ratios between 0.6 and 2.1 (see Fig. 1). XRD measurements and TEM pictures helped to better understand the intriguing interplay between precipitation conditions and final nanoparticle properties.

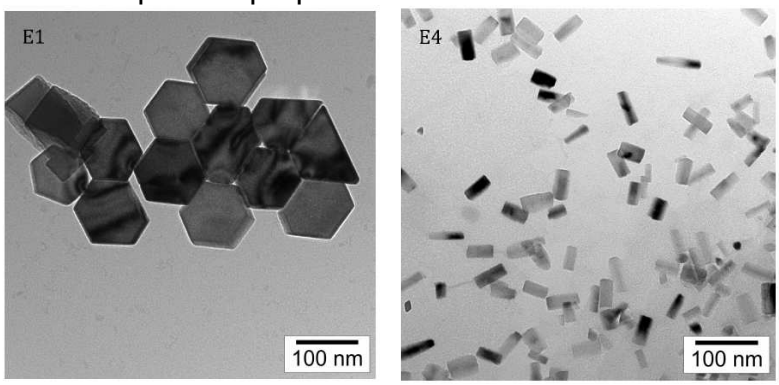

Fig. 1: Two different process conditions lead to different sizes and shapes of ZnO nanoparticles: left – low zinc acetate concentration, right – high zinc acetate concentration.

Conclusions

Easy accessible technical parameters can be used to influence the crystal *shape* of ZnO nanoparticles prepared in miniemulsions. Concentration changes or variation in ratios of educts lead to different shapes of ZnO nanohexagons from rod-like to plate-like. Our results show that a generation of particular surfaces is achievable via the implementation of technical means without further additional steps where the nanoparticles would have to be touched or treated in some way. Processes like this may be applied in the large-scale production of valuable material for catalysis or pharmaceutical products making these processes more efficient and cost-effective.

References

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