PREPARATION AND PROPERTIES EVALUATION OF ZnO NANOPARTICLES

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Abstract

Very prospective area of usage nanocomposite systems is paint industry, when addition of small amount of suitable nanoparticles leads to positive affecting a number of properties of modified materials. Option of suitable nanoparticles, their compatibility with final mediums, eventually suitable option of dispersing methods are important for application. For paint industry are very important nanoparticles, which positively influence several properties of paint film at once. As a sample of such material it is possible to state nanoparticle zinc oxide. Zinc oxide was prepared by precipitation method. Methods acoustic spectrometry, atomic force microscopy and transmission electron microscopy were used for evaluation of shape and size distribution of ZnO nanoparticles.

Keywords: nanoparticle zinc oxide, zinc oxide preparation, particle size distribution

1. INTRODUCTION

Recently, a great attention is paid to study of preparation and properties of nanomaterials usable in many industrial applications. These materials are utilized in various fields of human activities – e.g. in electronics, medicine, cosmonautic, car industry etc. Very prospective area of application of nanocomposite systems is paint industry, where addition of small amount of suitable nanoparticles positively affects a number of properties of modified materials such as weatherability, thermostability, and resistance against different solvents. Selection of suitable dispersion methods, types of nanoparticles and their compatibility with binders are important factors for effective application.

2. WORK SCOPE

For paint industry are very important nanoparticles, which positively influence several properties of paint film at once. An example of such material is nano-size zinc oxide, which has two very important functions for paint films. ZnO nanoparticles act as an UV filter and shows antibacterial effect at the same time. Our attention was paid to preparation of zinc oxide nanoparticles of acceptable price and providing desirable physical properties.

3. EXPERIMENTAL

For preparation of zinc oxide precipitation method was selected, which was modified for aqueous and nonaqueous systems. Used raw materials were solutions of NaOH, Zn(CH₃COO)₂.H₂O and special type of stabilizer. Six colloidal solutions was prepared with increasing concentration of stabilizer (1,21%, 3,54%, 4,03%, 5,22%, 6,84% a 10,44%).
4. RESULTS

Particle size distribution in colloidal solution is highly influenced by stabilizer concentration. With increasing stabilizer concentration distribution curve direct towards lower valuables particle size (Fig.1).

Similar results give AFM method also. With increasing concentration of stabilizer decrease particle size of ZnO (Fig. 2 and Fig.3).

Particle size in sediment is only little influenced by stabilizer concentration (Fig.4 and Fig.5). The amount of sediment decrease with increasing stabilizer concentration. In case of highest stabilizer concentration (10.44%) was observed only minimal sediment.
5. CONCLUSIONS

Fundamental significance for nanoparticle size and polydispersity has suitable type and concentration of stabilizer. Acoustic spectrometry, AFM and TEM were utilized as methods suitable to study effect of stabilizer concentration on these parameters. The same methods were used to classification of studied colloidal system stability. It was observed sedimentation of certain part of zinc oxide particles within system, whereas particle size decreases with increasing concentration of stabilizer. Fundamental question was, whether the sediment is formed by larger primary particles or by aggregates of them. To explain this effect, the shape and size of particles in colloidal solution and sediment were studied by AFM and TEM methods.

This work has been supported by the projects FT-TA3/055 and FT-TA4/074 of the Ministry of Industry and Trade of the Czech Republic and has been supported from the resources of the research intention MSM 0021627501.