Hybrids of Polymer Colloids and Inorganic Nanoparticles – Synthesis, Characterization, and Application in Catalysis

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Metallic nanoparticles have been the object of intense research during recent years because of their catalytic activity. Applications in catalysis, however, require systems that act as carriers in order to prevent the coagulation of the particles. Moreover, active carriers may act as "nanoreactors" that allow us to tune the activity of nanoparticles. We have recently introduced spherical polyelectrolytes and core-shell microgels as such carriers. In my lecture I shall present at first our most recent work in this field, namely studies on the catalytic activity of nanoalloys bound to spherical polyelectrolyte brushes. Here nanoparticles are formed from two metals that may or may not be miscible in the bulk state. We have recently worked on nanoalloys formed from Au and Pt [1] and from Au and Pd [2]. The reduction of 4-nitrophenol by sodiumborohydride has been used as a model reaction. Nitrophenol is reduced to aminophenol without side reactions and the reaction takes only place in the presence of metallic nanoparticles [2,3]. We have recently studied this model reaction in more detail and I#ll give a detailed mechanistic account. Using this reaction we could demonstrate that Au/Pd nanoalloys are better catalysts than either Au- or Pd-nanoparticles [2].

In a second part I shall discuss hybrids consisting of metallic nanoparticles and colloidal microgels. Here I'll present our recent work on microgels used as "nanoreactors" that allow us to turn on and off the catalytic activity of nanoparticles to a certain extend [4]. In addition, the catalytic activity of nanoparticles enclosed in yolk-shell microgels will be shown [5]. These systems allow us to tune the catalytic activity of nanoparticles by simple external parameters as e.g. the temperature.

Literatur:

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