"(photo)chemistry at nanoparticulate systems"

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Nanoparticulate systems are fascinating materials as they show unique properties especially within a size regime below a few nanometers. This is the reason why the study of nanocrystals is one of the fastest developing fields in chemistry over the last years. Particular attention has been drawn towards the size regime in which the change of certain properties occurs from bulk-like behaviour to properties reminiscent of molecules. Not only the fundamental chemical and physical interest within these systems has attributed to the rapid development of the field but also the high potential of new and partly realized technical applications. Examples are heterogeneous catalysts or the question of limits for reducing microelectronic devices. Real catalysts frequently consist of nm-sized (1-100 nm) metal particles deposited on the internal surface of a more or less inactive porous support. The processes taking place during a chemical reaction are rather complex and involve the interplay of the reaction kinetics on different facets of supported particles due to interfacet diffusion, adsorbateinduced reshaping of catalytic particles, oscillation and chaos on the nm scale as well as reactant supply via the support. But even the simple interaction of the particles with a support or with adsorbates can modify the properties with respect to the bare material. For example carbon monoxide adsorbed at a palladium particle on an alumina support consisting of about 100 atoms can show carbonyl like behaviour, if the particle coverage is saturated. A 50% coverage however exhibits characteristic features similar to CO adsorbed at bulk material. On the other hand bare palladium particles down to 10 atoms on alumina have characteristics of metals.

Within the talk adsorption of molecules like CO, NO and methane at palladium particles of diameters between 5 Å and 80 Å will be discussed in more detail as a function of palladium aggregate sizes and different morphologies to enlighten the various aspects of nano materials. Particular emphasis will be put on chemical reactions triggered by electronic excitation after irradiating the system with UV-laser light. It will be demonstrated that different reaction channels for methane activation are populated depending on the aggregate size just to name one example out of a number of interesting aspects of photochemistry at those systems. But also diffusion (CO) and desorption processes (NO) will be reported partly involving quantum state resolution. Particular interest will be put on adsorbate induced roughening of Pd-particles after coherent excitation of the adsorbate system with femtosecond laser pulses.