

## INM-KOLLOQUIUM

### “SUPERSTRUCTURES OF COLLOIDAL NANOCRYSTALS”

Prof. Dr. Alexander Eychmüller

Physical Chemistry, TU Dresden

Thursday, May 4, 2017, 11:00 am

INM, Leibniz-Saal, Campus D2 5

Host: Prof. Dr. Tobias Kraus

Gels and aerogels manufactured from a variety of nanoparticles available in colloidal solutions have recently proven to provide an opportunity to marry the nanoscale world with that of materials of macro dimensions which can be easily manipulated and processed, whilst maintaining most of the nanoscale properties. The materials carry an enormous potential for applications. This is largely related to their extremely low density and high porosity providing access to the capacious inner surface of the interconnected nanoobjects they consist of. The aerogel materials may be further processed in order to achieve improvements in their properties relevant to applications in optical sensing and catalysis.

The commercialization of polymer electrolyte fuel cells (PEFC) is still hindered by the cathode electrocatalyst for the oxygen reduction reaction (ORR) not fulfilling the criteria of low cost, high performance, and high durability. We recently developed a facile strategy for the controllable synthesis of nanoparticle-based bimetallic  $Pt_xPd_y$  aerogels with high surface area and large porosity, which act as highly active and stable catalysts for the ORR in PEFC cathodes. In addition to excellent durability the  $Pt_xPd_y$  aerogels show superior electrocatalytic activity towards the ORR with the  $Pt_{80}Pd_{20}$  aerogel exhibiting a five times mass activity enhancement compared to commercial Pt/C catalysts. Extensions of this strategy will briefly be outlined.

As a further example of an application of these nanotechnologically derived non-ordered superstructures, we present the catalytic activity towards the methanol steam reforming. The aerogel is formed by de-stabilizing a ZnO nanoparticulate sol in the presence of Pd and subsequent supercritical drying. Further processing yields an intermetallic Zn-Pd phase of extremely small dimensions taken responsible for the high catalytic activity of the aerogel material.

The remainder of the presentation will be devoted to a) ordered superstructures of nanoparticles, and b) nanocrystals incorporated into macrocrystals of varying compositions. The ordered superstructures (mesocrystals) are composed of IV-VI semiconductor nanocrystals (8 – 15 nm in diameter) and stretch to dimensions in the 100 micrometer range. In the latter superstructures the nanocrystals exhibit remarkable photostabilities and enhanced emission quantum yields holding promise for colour conversion applications.

Wir laden 15 Minuten vor Beginn zu einem Get-together mit dem Referenten ein.

#### KONTAKT

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