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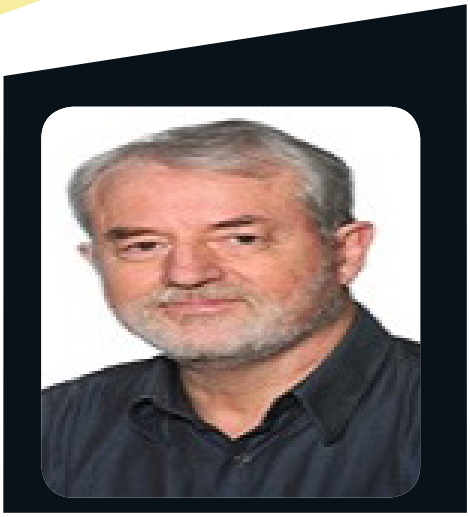

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SHORT RANGE ORDER, CRYSTAL NUCLEATION AND CRYSTAL GROWTH IN LIQUID COLLOIDAL SUSPENSIONS

Colloidal suspensions are model systems to study phase transformations of first order as crystallization of a liquid system. The particles of colloidal suspensions are in size of several hundred nanometres and the carrier fluid is transparent in the spectrum of visual light. These characteristic features make colloidal suspensions easily accessible for optical investigations. The structural transformations are very sluggish and can be monitored *in-situ*. In the present work, light scattering experiments are performed to investigate homogeneous nucleation in the interior and heterogeneous nucleation on the container walls of silica colloidal suspensions and to measure the growth velocity of the crystal. Since nucleation processes require short-range ordering as precursor of their formation, we conduct ultra-small-angle scattering of X-rays of synchrotron radiation at DESY Hamburg to determine the topological short-range order of monodisperse colloidal suspensions in liquid phase far away from thermodynamic equilibrium. In such a way, the entire pathway of crystallization from the stable liquid to the metastable liquid state, the formation of short-range ordering over crystal nucleation and eventually crystal growth is quantitatively investigated. The experimental results are analysed within current models of formation of aggregates of different structure, classical nucleation theory and the Wilson-Frenkel theory of crystal growth. From measurements of crystal growth and its analysis within the Wilson-Frenkel theory, the deviation from thermodynamic equilibrium of a shear melted crystal is inferred as defined by the difference of chemical potential between the metastable liquid and the stable solid. The *in-situ* investigations of homogeneous crystal nucleation are used to determine the solid-liquid interface which is very difficult to measure by other methods. The measurement of the growth of a planar liquid-solid interface allows for detailed information of the particle attachment kinetics of particles from the liquid to the crystal.

Biography

Dieter M Herlach has studied Physics at the RWTH Aachen University and has received the Doctoral degree as *Doctor rerum naturalium* from the same university. He was Group Leader at the Institute of Materials Physics in Space and Senior Scientist of the German Aerospace Center DLR. He is Full Professor in Physics at Ruhr-Universität Bochum (RUB). He has authored over 300 scientific publications in refereed journals and served as Editor of six books. He educated more than 30 PhD students. He lead projects of the German Research Foundation, the German Aerospace Center-Space Management, European Space Agency and was Principal Investigator of NASA during three spacelab missions. He initiated and coordinated two priority programs of the German Research Foundation (DFG), He is Honorary Professor of three universities. He chaired the Division of Metal and Materials Physics of the German Physical Society DPG, and was an Elected Member of the council of DPG, General Review Committee of DFG and Deputy Chairman of the German Society of Materials Science and Engineering.

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NEW TENDENCY OF MODIFIED GRAPHENE WITH DIFFERENT METHODS FOR THE PHOTOCATALYTIC APPLICATIONS

Due to its unique atom-thick 2D structure and remarkable physicochemical properties, graphene has been sparked a flurry of research into its optical, electronic, thermal, and mechanical properties. In particular, a great deal of recent attention has been attracted to explore graphene and graphene composites for photoelectrochemical applications. Recently, much works have been done on attempting to design and prepare novel graphene-based materials for a wide range of applications in photo-electrochemistry, ranging from photoelectrochemical solar cells, photocatalytic decomposition of organic pollutants, and H2 evolution. In this feature article, we summarize the state of research on graphene-based materials for photo-electrochemistry. The prospects and further developments in this exciting field of graphene-based materials are also discussed

Biography

Won-Chun Oh is a Professor in the Department of Advanced materials and engineering at Hanseo University in Korea and School of Materials Science and Engineering at Anhui University of Science and Technology in China. He obtained a Ph.D. degree at Dankook University in 1995. And, he is guest professor in some of Universities in China, Thailand and Indonesia. He obtained the 'Research Front' award, 'Yangsong' award, "Excellent Paper Award", and the Best Paper Award" in 2011, 2012 and 2015, and Award of appreciation from ICMMA2011 and ICMMA2014. He is appointed as one of the "Conference Chairman and Local Chairman" from 2007 to present year. His current research fields are nanostructured materials such as metal/nanocomposite, graphene materials and metal nanoparticles, and their catalytic applications for future energy sources and green chemical technologies. He is the author or a coauthor of 693 papers published in domestic and international journals. He serves as the Editor-in-Chief of the Journal of Multifunctional Materials and Photoscience, Asian Journal of Materials Chemistry and the Advisory Board Member of the Asian Journal of Chemistry.

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THE CHEMISTRY OF GRAPHENE AND ITS INORGANIC ANALOGUES

The chemistry of graphene is growing rapidly in last decade and broad range of graphene derivates was prepared. Nevertheless, only two stoichiometric derivates are currently known: hydrogenated and fluorinated graphene (graphane and fluorographene). Compared to graphene, these materials exhibit significantly different properties, e.g. higher reactivity as well as large differences in physical properties. Especially fluorographene can be applied as a substrate for nucleophilic substitution reactions, which significantly extend the possible chemical modifications of graphene. Currently, the chemistry of the other 2D materials starts to be explored. However, the chemistry of inorganic 2D materials like pnictogens and transition metal dichalcogenides is not well known and only several procedures were already reported. In comparison with graphene, new synthetic protocols have to be applied because the chemistry of these materials is extremely variable. In the case of transition metal dichalcogenides, the formation of the M-X-C bond (M is a metal, X is any chalcogenide) can be used as a starting point for exploring their chemistry and for further derivatisation. The chemistry of layered pnictogens is significantly different. In this case, various reactions including nucleophilic substitution can be applied, however, the bonding through the oxygen functionalities on pnictogen surface is observed in many cases

Biography

Zdenek Sofer is an Associated Professor at the University of Chemistry and Technology Prague since 2013. He received his PhD also at University of Chemistry and Technology Prague, Czech Republic, in 2008. During his PhD, he spent one year in Forschungszentrum Julich (Peter Grünberg Institute, Germany) and later, one Postdoctoral stay at University Duisburg-Essen, Germany. His research interests include nanomaterials graphene-based materials and other 2D materials, its chemical modifications, reactivity and applications in electrochemistry, separation and electronic. He is a Member of Editorial board of FlatChem. He has published over 300 articles, which received over 5000 citations (h-index of 35).

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