

PROBLEMS, DEVELOPMENT TRENDS, AND CHALLENGES IN PHYSICAL CHEMISTRY

Interfacial Synthesis: Morphology, Structure, and Properties of Interfacial Formations in Liquid–Liquid Systems

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Abstract—The results of studies in the field of interfacial synthesis and interfacial formations in liquid–liquid systems are summarized. The mechanisms of the processes of interfacial synthesis are considered. Data on the self-assembly of nanoparticles, films, and 3D materials are given. The properties of materials of interfacial formations in systems with rare-earth elements and di(2-ethylhexyl)phosphoric acid, obtained both in the presence and absence of local vibrations, are described. It was established that materials obtained in the presence of local vibrations in the interfacial layer have higher density, melting point, and magnetic susceptibility and lower electric conductivity. The effect of force field parameters on the properties of interfacial formations is considered. Practical applications and prospects for research in the field of interfacial formations are discussed.

Keywords: vibrational action, interfacial synthesis, nanomaterials, self-assembly, rare-earth element

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Interfacial synthesis proceeds in heterophase liquid systems by a chemical reaction between substances that are initially in different liquid phases. The reaction can take place on a flat surface that separates immiscible liquids, or on a nonflat surface in microemulsions. There is a detailed review on microemulsions [1]; therefore, reactions in microemulsions are not discussed in the present work. An interfacial reaction can be polymerization, which has long been used to obtain polymer films. The present review considers only those publications on polymerizations that reported the preparation of nanomaterials [2, 3].

As a result of a heterophase reaction, the molecules of a new substance are formed at the liquid–liquid interface and can be localized at the interface or distributed in the liquid. The molecules localized at the interface can form nanoparticles (NPs); in this case, nanomaterials form by the “bottom-up” method. The liquid–liquid interface promotes self-organization and self-assembly of nanoparticles (NPs). The self-assembly of NPs was widely discussed in the literature. Reviews [4–10] described the approaches to the creation of ordered structures of nanoparticles, gave examples of formation of these structures, and analyzed the driving forces of self-organization and the physicochemical properties of ordered assemblies. The authors of [4] underlined the importance of understanding the driving forces of interfacial assembly, seeking new methods for use as probes for interfacial assembly, and controlling particle interactions and

the possibility of external effects. The fundamentals and applications of liquid–liquid interface for the creation of complex fully liquid devices with many potential applications were reviewed in [7]. Review [8] focused on modification of the interface with assemblies of gold nanoparticles or nanofilms. The behavior of self-assemblies of biological and synthetic particles was discussed in [9]. According to the authors, the interfacial assembly of single-walled carbon nanotubes at liquid interfaces will play a key role in some applications such as fractionation of nanotubes, fabrication of thin films, and synthesis of porous foam plastics and polymer composites. The use of functionalized interfaces of two immiscible electrolyte solutions in electrocatalysis and electroanalysis of modified boundaries was considered in [10].

Interest in interfacial formations in systems with organic acids and salts of *d* and *f* elements was dictated by their practical utility and prospects for production of nanomaterials with desired properties on their basis. Moreover, the properties of these materials depend on the conditions of their preparation, in particular, on the presence of an external force field that can affect both the interfacial synthesis and the self-assembly of nanoparticles at the interface.

The effects of the vibration field on the interface synthesis and interface formations were considered in [11, 12], but not reviewed. Here we made an attempt to fill this gap. The review presents the interfacial syntheses of substances that give metal nanoparticles, metal

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The Publishers' Trade List Annual, 1985 **Catalog of Copyright Entries. Third Series** Library of Congress. Copyright Office, 1978 **Recent Developments in Separation Science** Norman N. Li, 1972 Books in Print Supplement, 1985 *Metallized Plastics 2* K.L. Mittal, 2013-11-11 This volume documents the proceedings of the Second Symposium on Metallized Plastics Fundamental and Applied Aspects held under the aegis of the Dielectric Science and Technology Division of the Electrochemical Society in Montreal Canada May 7 10 1990 The first symposium on this topic was held in Chicago October 10 12 1988 and the proceedings of it which have been chronicled in a hard bound volume I As pointed out in the Preface to the proceedings of the first symposium the metallized plastics find scores of applications ranging from very mundane to very sophisticated Even a cursory look at the literature will convince that this field has sprouted and there is every reason to believe that with all the research and development activities taking place new and exciting applications of metallized plastics will emerge The program for the second symposium was very comprehensive as it included 46 papers covering many aspects of metallized plastics This symposium was a testimonial to the brisk research activity and keen interest in the topic of metallized plastics The success of this symposium reinforced our earlier belief that there was a definite need to hold symposia on this topic on a regular basis Concomitantly the third symposium in this vein was held in Phoenix Arizona October 13 18 1991 and the fourth is planned for May 16 21 1993 in Honolulu Hawaii As regards the present volume it contains a total of 35 papers covering a variety of topics ranging from very fundamental to very applied

Modern Luminescence from Fundamental Concepts to Materials and Applications, Volume 2 Surender Kumar Sharma, Carlos Jacinto da Silva, Daniel Jaque Garcia, Navadeep Shrivastava, 2024-11-14 Modern Luminescence from Fundamental Concepts to Materials and Applications Volume Two Luminescence in Materials is part of a multivolume work that reviews the fundamental principles properties and applications of luminescent materials Topics addressed include 1 The key concepts of luminescence with a focus on important characterization techniques to understand a wide category of luminescent materials 2 The most relevant luminescent materials categories including both current and emerging materials and 3 The applications of luminescent materials in biomedicine solid state devices and the development of hybrid materials This updated volume reviews the most relevant luminescent materials including transition metals rare earth materials actinide based materials and organic materials In addition the book reviews luminescence mechanisms in relevant emerging materials and the optical techniques used to characterize these materials Provides an overview of luminescence mechanisms in transition and rare earth elements actinides and organics Reviews the latest advances in optimizing luminescent properties in materials Includes experimental spectroscopic techniques to analyze luminescent materials

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Table of Contents Interfacial Synthesis Vol 1 Fundamentals

1. Understanding the eBook Interfacial Synthesis Vol 1 Fundamentals
 - The Rise of Digital Reading Interfacial Synthesis Vol 1 Fundamentals
 - Advantages of eBooks Over Traditional Books
2. Identifying Interfacial Synthesis Vol 1 Fundamentals
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Interfacial Synthesis Vol 1 Fundamentals
 - User-Friendly Interface

-
4. Exploring eBook Recommendations from Interfacial Synthesis Vol 1 Fundamentals
 - Personalized Recommendations
 - Interfacial Synthesis Vol 1 Fundamentals User Reviews and Ratings
 - Interfacial Synthesis Vol 1 Fundamentals and Bestseller Lists
 5. Accessing Interfacial Synthesis Vol 1 Fundamentals Free and Paid eBooks
 - Interfacial Synthesis Vol 1 Fundamentals Public Domain eBooks
 - Interfacial Synthesis Vol 1 Fundamentals eBook Subscription Services
 - Interfacial Synthesis Vol 1 Fundamentals Budget-Friendly Options
 6. Navigating Interfacial Synthesis Vol 1 Fundamentals eBook Formats
 - ePub, PDF, MOBI, and More
 - Interfacial Synthesis Vol 1 Fundamentals Compatibility with Devices
 - Interfacial Synthesis Vol 1 Fundamentals Enhanced eBook Features
 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Interfacial Synthesis Vol 1 Fundamentals
 - Highlighting and Note-Taking Interfacial Synthesis Vol 1 Fundamentals
 - Interactive Elements Interfacial Synthesis Vol 1 Fundamentals
 8. Staying Engaged with Interfacial Synthesis Vol 1 Fundamentals
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Interfacial Synthesis Vol 1 Fundamentals
 9. Balancing eBooks and Physical Books Interfacial Synthesis Vol 1 Fundamentals
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Interfacial Synthesis Vol 1 Fundamentals
 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
 11. Cultivating a Reading Routine Interfacial Synthesis Vol 1 Fundamentals
 - Setting Reading Goals Interfacial Synthesis Vol 1 Fundamentals
 - Carving Out Dedicated Reading Time

-
12. Sourcing Reliable Information of Interfacial Synthesis Vol 1 Fundamentals
 - Fact-Checking eBook Content of Interfacial Synthesis Vol 1 Fundamentals
 - Distinguishing Credible Sources
 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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