THEORETICAL AND PRACTICAL ASPECTS OF COLLOID SCIENCE AND SELF-ASSEMBLY PHENOMENA REVISITED

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ABSTRACT

Colloid chemistry and self-assembly phenomena present an essential aspect of the design of fine material structures and devices in the coming era. Numerous uncertainties, however, pervade this practical field, including the questionable processing potential of pre-synthesized self-assembled systems in the design of advanced material structures. Despite the current belief in advancement of knowledge on stereoscopic molecular recognition and molecular assembly manipulation that might eventually open the door to perfect control inherent in the design and processing of ultra-fine macroscopic structures, trial-and-error interactive aspects seem to be inherent not only to the synthetic approaches in the frame of contemporary colloid chemistry, but to biomolecular recognition processes as well. After referring to the historic trend of descent of scientific interest towards physical processes that occur at ever finer size scales in the first and introductory section, the next section describes the basic notions and the founding aspects of the field of colloid chemistry. Dichotomy of the so-called 'top-down' and 'bottom-up' approaches to the design of ultra-fine structures and technologies is first mentioned in the Sec.3. The prospects and demerits of both synthetic methodologies are discussed in the same section. The basics of the conceptual framework of DLVO theory, altogether with the major approximations and the resulting limitations in its application, are discoursed in Sec.4. The relationships between theoretic and experimental variables in the framework of colloid chemistry are first expounded in Sec.5, in which numerous examples of pronounced sensitivities of colloid systems on changes in the boundary conditions are given. Uncertainties and