

Ionic Soft Condensed Matter

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The term 'ionic condensed matter' means charged high-density matter which consists of a strongly Coulomb-coupled many-body system found in the universe, daily products, and biological environments [1-6]. It includes either a high-density, high-temperature plasma (or crystal) or a molecular assembly of liquid or solid state at room temperature. The former of ionic condensed matter corresponds to hard condensed matter such as white dwarfs, metallic hydrogen, and dusty plasmas. Graphite which is often used in fusion device walls and nano-fabrication can be naturally eroded through adsorption of many hydrogen atoms [1]. The latter of ionic condensed matter may be called ionic soft matter, and includes polymers, colloids, DNA, and proteins - building blocks of our life. Randomly charged polymers, which may be used for modeling of proteins, fold/unfold or crystallize depending on temperature and solvent quality [2,3]. Soft matter also includes water as medium to assist various chemical reactions and to contain life objects. Hydrogen bonds are often the cause of rigid structures as in double-helix DNA and ice. Incidentally, ionic soft matter is not only useful but also appropriate for serious studies. For example, ions with equal-sign charges can aggregate, or a particle with surface charges can be strongly charged with an opposite sign in the presence of multivalent counterions at normal temperature [4,5]. DNA translocating through biological membrane pores of nanometer sizes is also affected by strong electrostatic forces [6]. These processes govern the structure formation and molecular reactions in our life processes.

References:

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