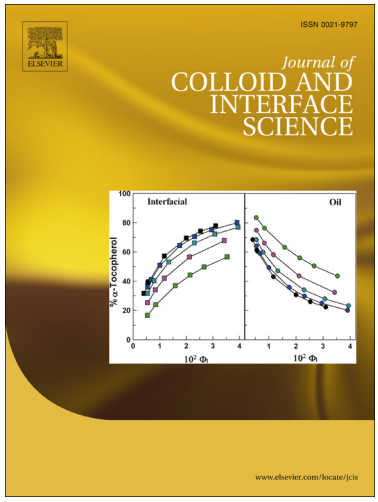

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Compact and ordered colloidal clusters from assembly-disassembly cycles: a numerical study

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Abstract

Brownian dynamics simulations are used to investigate the assembly of attractive colloids whose interaction potential well is periodically changed over time. Our system is composed of spherical, mono-disperse, highly charged, alumina particles whose interactions are modeled by the DLVO theory. The depth of the potential well is periodically changed by varying the ionic strength of the liquid medium. The simulations show that, with a right choice of some key parameters, a potential well depth alternating between low and higher value allows a faster aggregation into more compact and also more ordered colloidal clusters. This result is quantified by the computation of two relevant coordination parameters during the aggregation. This finding may help elucidate the assembly of colloidal particles in complex biological processes (e.g. biomineralization) and could be useful for the development of photonic crystals from attractive colloidal particles.

Keywords: Brownian dynamics, colloidal crystals, structure optimization

1. Introduction

The assembly of colloidal particles into large clusters and superstructures occurs in a wide range of scientifically and technologically important systems, ranging from ceramic processes [1, 2] and food products [3] to photonic crystals [4] and biomineralized

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