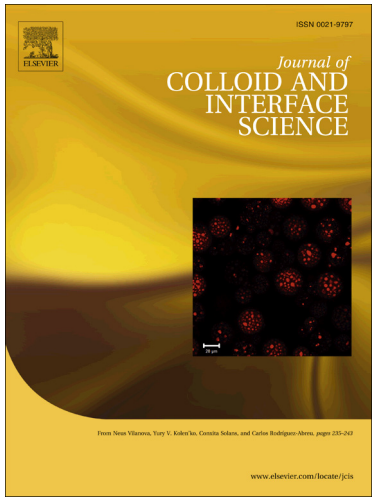
Accepted Manuscript



Estimation of drying length during particle assembly by convective deposition

Kedar Joshi, James F. Gilchrist

PII: S0021-9797(17)30105-4
DOI: http://dx.doi.org/10.1016/j.jcis.2017.01.083
Reference: YJCIS 21989

To appear in: *Journal of Colloid and Interface Science*

Received Date: 10 October 2016
Revised Date: 9 January 2017
Accepted Date: 22 January 2017

Please cite this article as: K. Joshi, J.F. Gilchrist, Estimation of drying length during particle assembly by convective deposition, *Journal of Colloid and Interface Science* (2017), doi: http://dx.doi.org/10.1016/j.jcis.2017.01.083

Estimation of drying length during particle assembly by convective deposition

Kedar Joshi and James F. Gilchrist*

Department of chemical and biomolecular engineering Lehigh University, Bethlehem, PA, 18015, USA

Abstract

Convective deposition is a scalable method for directing colloidal self-assembly. Ordered layers of deposited particles have numerous applications as advanced materials for optical devices and membranes. Over the past 20 years, a simple mass balance derived by Dimitrov and Nagayama has been widely used for relating film thickness to deposition velocity, suspension concentration and evaporation rate and particle size. This balance works well for a small range of deposition velocities, but it fails to predict the coating thickness over a broader range. Specifically, in this balance the length scale related to drying is not well-posed and the drying length generally thought to be roughly constant. This work derives an analytical expression for the drying length in convective deposition for a more general set of conditions by considering the resistance to flow through the deposited particles. This analysis allows prediction of coating thickness over a wider range of velocities from low density coatings to multilayer particle assemblies.

* Author to whom correspondence should be addressed. Electronic mail: gilchrist@lehigh.edu