Collecting silica microparticles using a vacuum-driven set-up

Introduction

The miniaturization of Liquid Chromatography (LC) columns has led to the use of columns operating at a pressure up to 1500 bar. Up till now the efficiency of LC has been improved by reducing the size of monodisperse spherical particles, which are randomly packed in high pressure columns, and simultaneously increasing the operating pressure. To achieve a more groundbreaking progress, a paradigm shift from randomly packed beds of microparticles to perfectly ordered microparticles is needed.
The most optimal ordered arrangement of microparticles is proposed by using a layer-by-layer manufacturing strategy. Each monolayer of silica particles is collected using a vacuum-driven membrane with an array of precisely positioned pores capable of reversibly holding the particles (Figure 1).

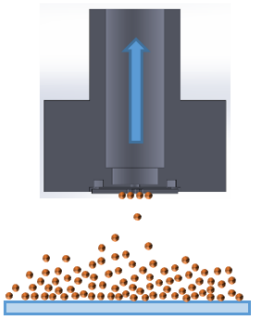

Figure 1 *Schematic representation of set-up*

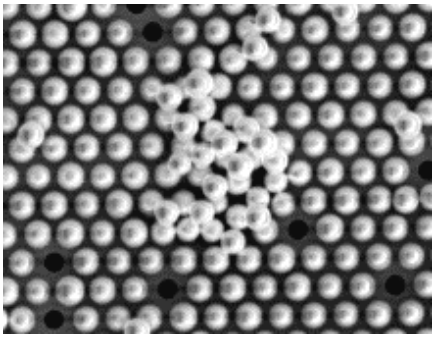

Figure 2 *Clusters of particles formed on top of collected monolayers*

Goal

Preliminary experiments have proven that we are able to collect 10 μm silica particles on a suction membrane connected to vacuum. However, some undesirable clusters form on the collected monolayer (Figure 2). To understand the formation of these particle clusters in order to improve the collection of solely a monolayer of microparticles, simulations are needed.

Tasks

The following tasks are identified:

1. Modelling of the flow field and the particles motion for different process conditions
2. Studying suitable conditions (vacuum pressure, membrane structure) for collecting the major goal of a monolayer of particles, without unwanted clustering
3. Study the interaction of particles during flight from supply tray to membrane

Contact

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