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Introduction

Among micro-fluidic particle separation devices there are several promising techniques to separate particles from suspensions on a large scale. The deterministic ratchet method (fig. 1) was evaluated to have highest potential for up scaling¹. The main advantage of deterministic ratchets compared with microfiltration is its low risk of particle accumulation due to the larger gap size.

¹Kulrattanarak et al., Adv. Coll. Interf. Sci. 142 (2008) 53–66

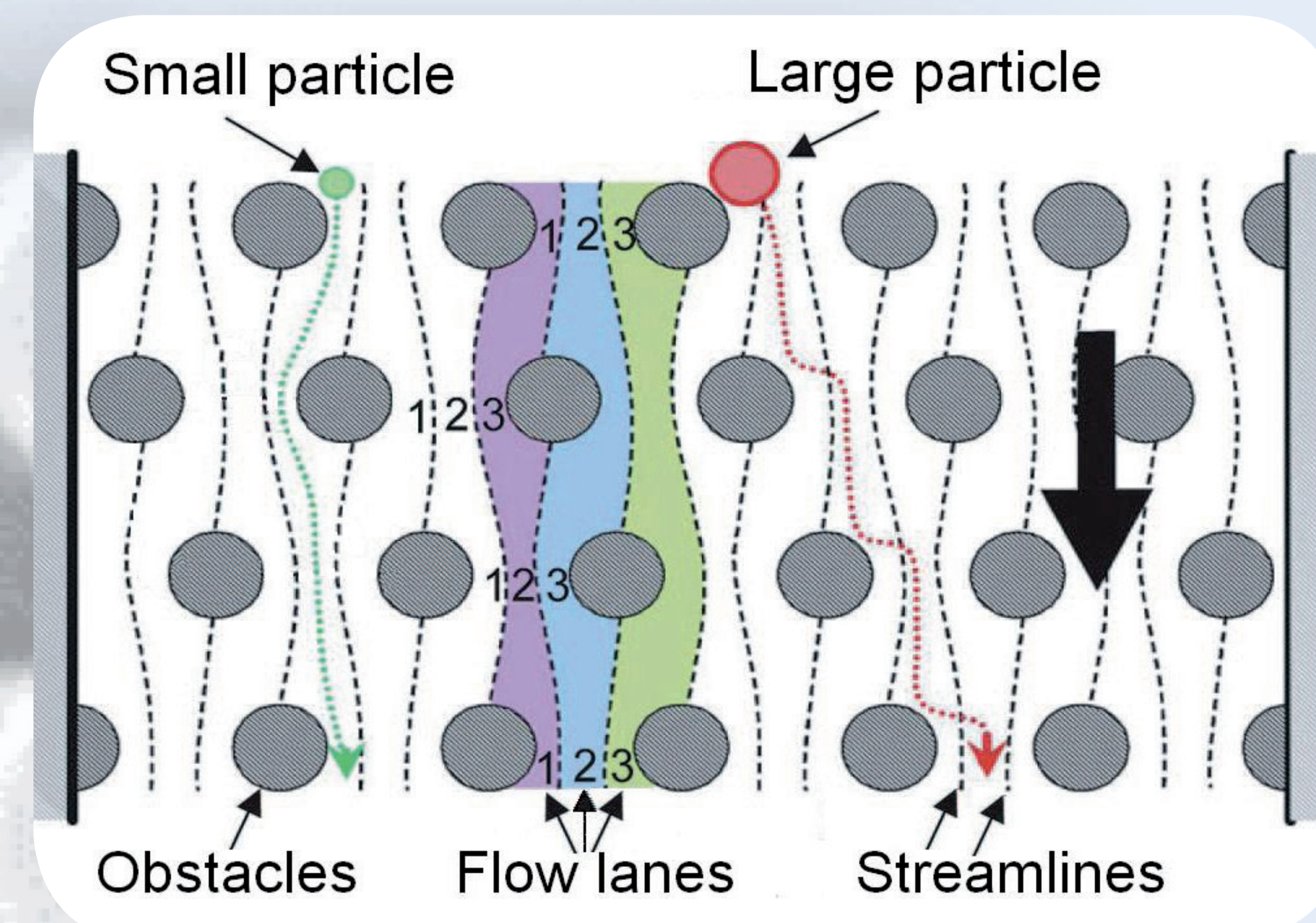


Figure 1: Top view of a deterministic ratchet array with visualized separation principle (Davis et al., PNAS 103 (2006) 14779-14784).

Aim

The aim of this project is to investigate up scaling of the deterministic ratchet technology by using micro sieves.

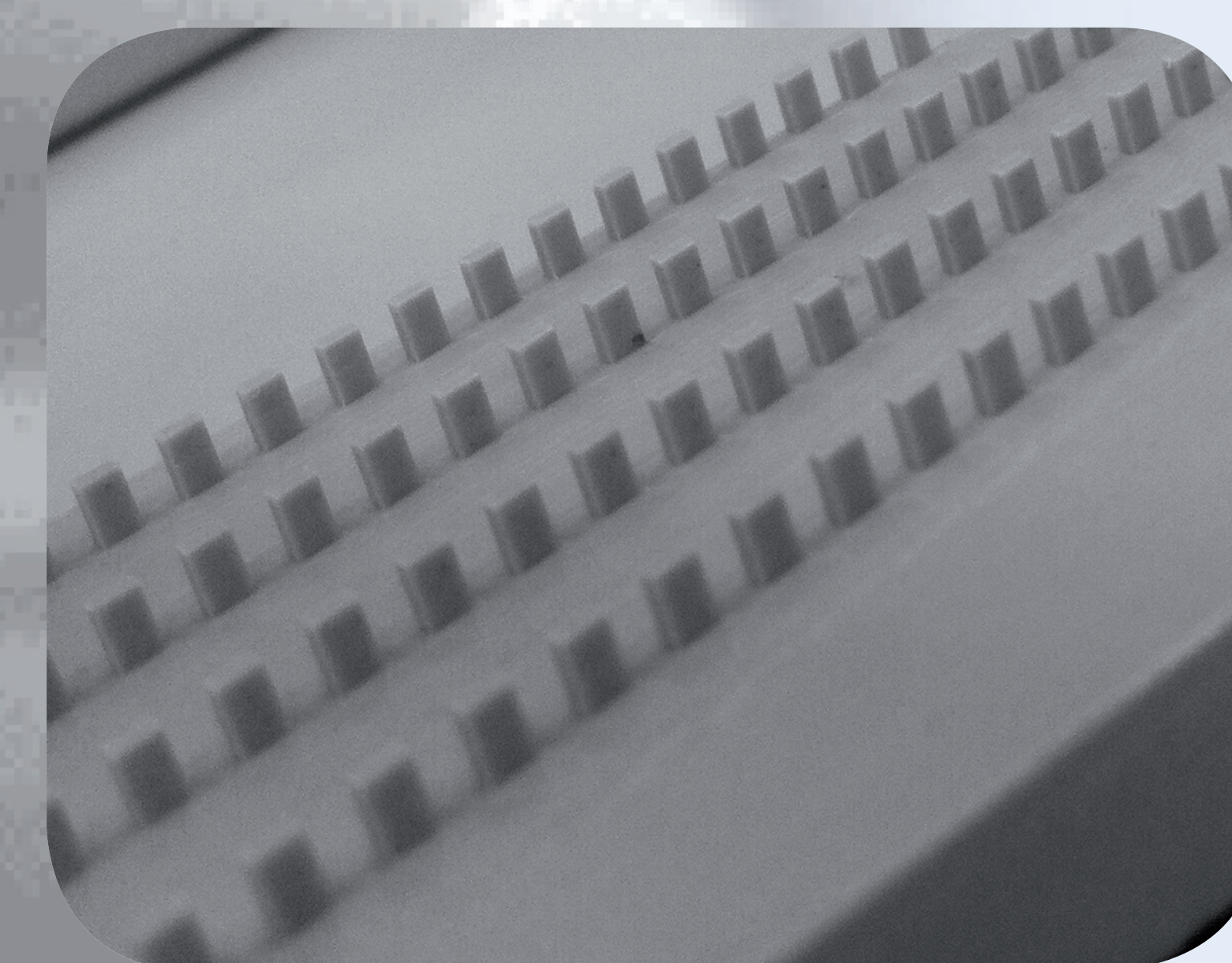


Figure 2: Sparse deterministic ratchet.

Approach

Explore implementation of metallic micro sieves (fig 4) to imitate obstacles by:

- Experimental analysis of the separation via outlet concentrations.
- Visualization of the particle trajectories using a high speed camera.
- Develop CFD simulations to optimize the design.

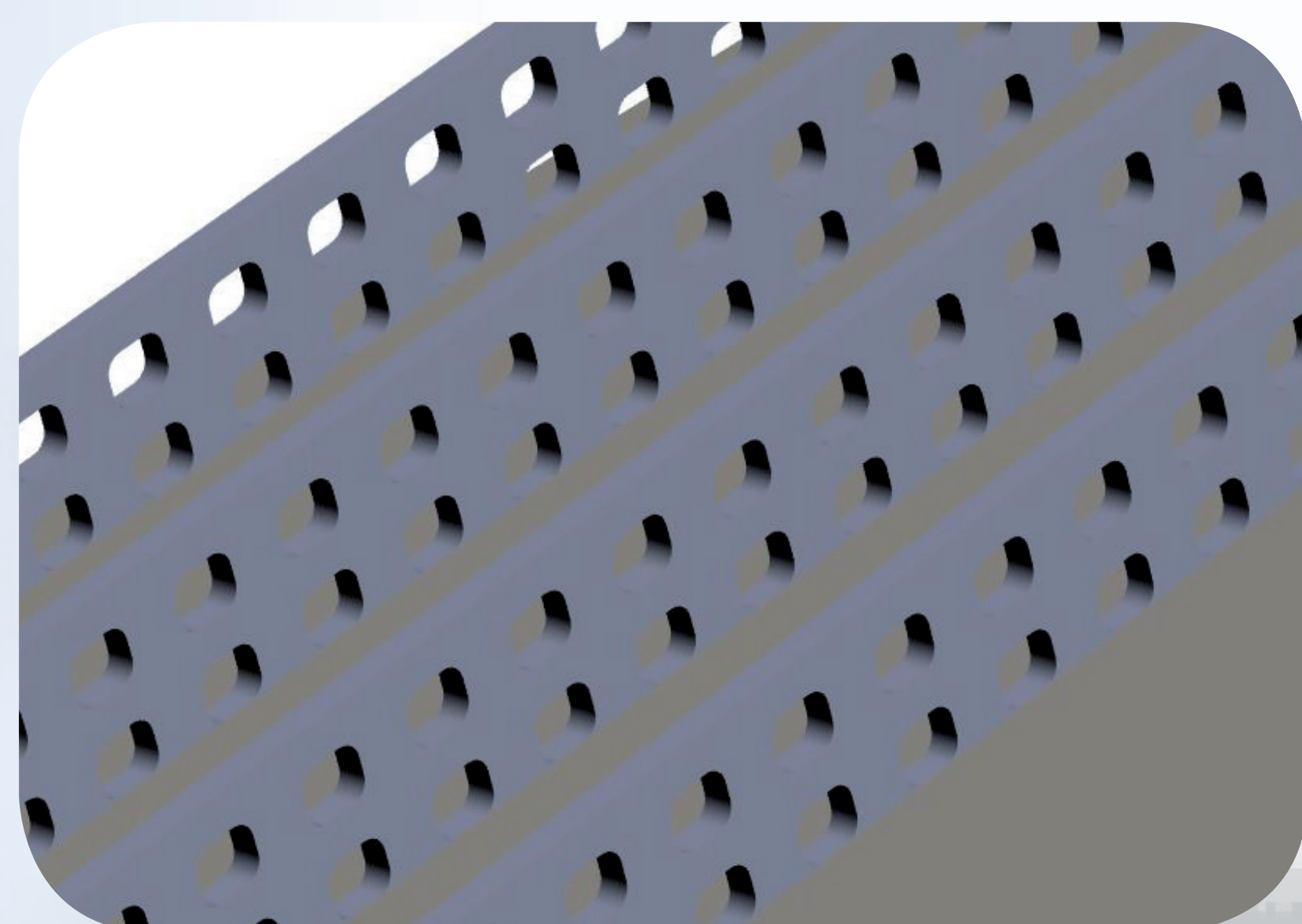


Figure 3: Using a sieve in a sparse deterministic ratchet allows doubling of the height of obstacles compared to figure 2.

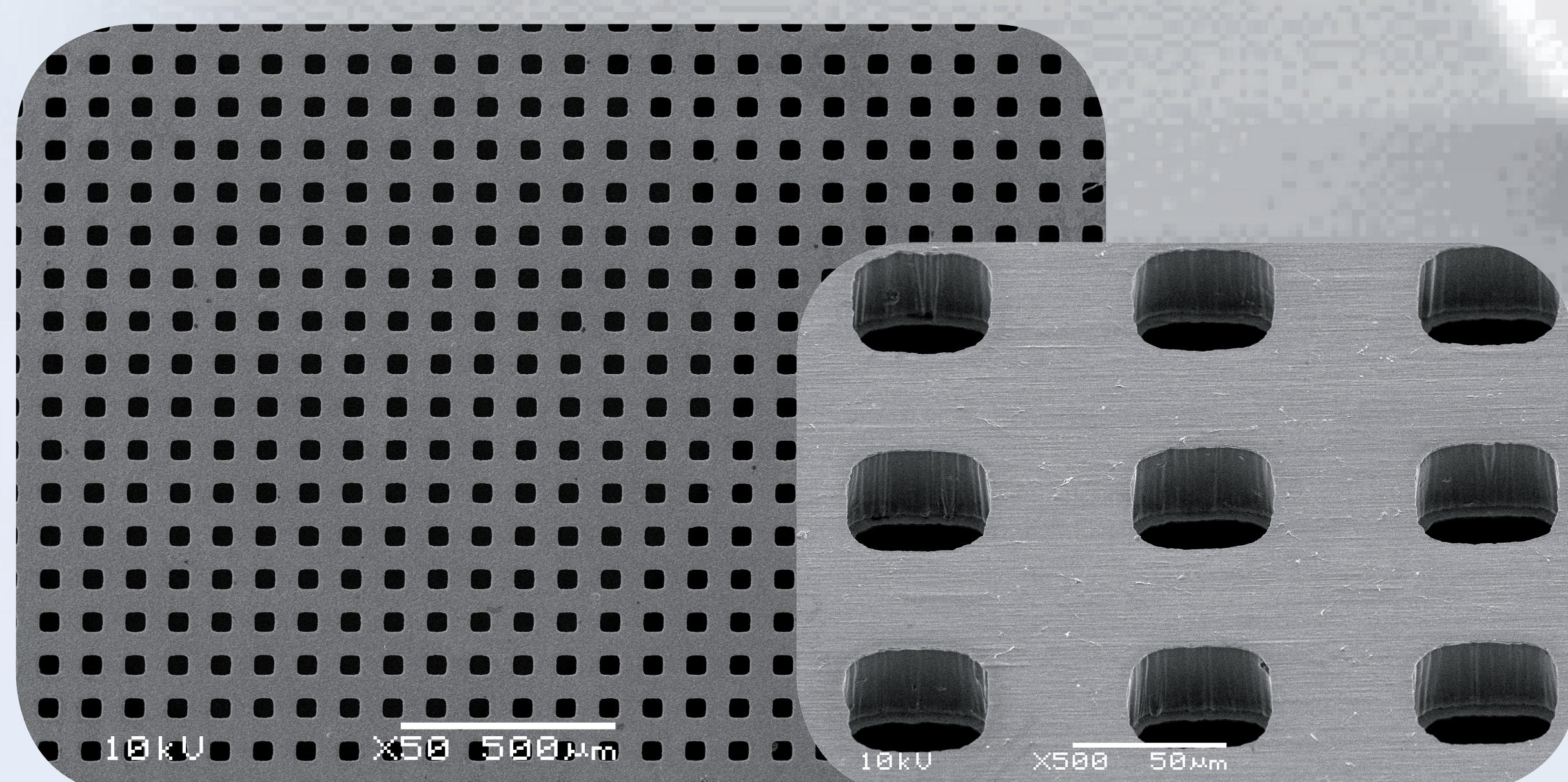


Figure 4: A metallic micro sieve

Challenges

- Separating smaller particles becomes increasingly more difficult.
- Establish optimal micro-sieve design.