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Modeling filtration and fouling with a microstructured membrane filter[1] LINDA CUMMINGS, New Jersey Institute of Technology, PEJMAN SANAEI, New York University — Membrane filters find widespread use in diverse applications such as A/C systems and water purification. While the details of the filtration process may vary significantly, the broad challenge of efficient filtration is the same: to achieve finely-controlled separation at low power consumption. The obvious resolution to the challenge would appear simple: use the largest pore size consistent with the separation requirement. However, the membrane characteristics (and hence the filter performance) are far from constant over its lifetime: the particles removed from the feed are deposited within and on the membrane filter, fouling it and degrading the performance over time. The processes by which this occurs are complex, and depend on several factors, including: the internal structure of the membrane and the type of particles in the feed. We present a model for fouling of a simple microstructured membrane, and investigate how the details of the microstructure affect the filtration efficiency. Our idealized membrane consists of bifurcating pores, arranged in a layered structure, so that the number (and size) of pores changes in the depth of the membrane. In particular, we address how the details of the membrane microstructure affect the filter lifetime, and the total throughput.

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Linda Cummings
New Jersey Institute of Technology

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