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Atomic and Molecular Separation through Porous Graphene

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Graphene, a single layer of graphite, represents the first two dimensional atomic crystal. It consists of carbon atoms covalently bonded in a hexagonal chicken wire lattice. This unique atomic structure gives it remarkable electrical, mechanical, and thermal properties. However, it is the mechanical properties of this material that fascinate our group the most. It is the thinnest and strongest material in the world as well as being impermeable to all standard gases. This high strength, extreme flexibility, and unprecedented barrier properties make graphene an intriguing material for membrane based filtration. Graphene acts as a barrier for gases and liquids and represent the thinnest membrane possible (one layer of atoms) with the smallest pore sizes attainable (single atomic vacancies), and unprecedented mechanical stability. In this talk, I will review our experimental work on gas and liquid ion transport through angstrom sized pores in suspended porous graphene membranes. These measurements help elucidate the fundamental molecular and ionic transport mechanisms in this unique material.