

Challenges in Graphene Nanopore-(Nanowindow)-based Molecular Separations: A Critical Review

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Opening holes in a graphene layer (nanowindows) can arguably create the thinnest possible separation membrane. This has been clearly explored and exploited during the last decade since it has provided us with an exponential growth in the number of publications claiming to use graphene as a single-layer separation membrane. However, the knowledge and synthesis techniques have, to this date, not been sufficiently developed to produce an efficient separation system. In this literature review we analyze and discuss the main reasons for this outcome. It is known that the experimentally synthesized membranes in most cases do not provide anywhere near the separation selectivities or permeation rates predicted by computer simulations. An important cause of this is that the computer simulation models currently available are too simplistic to account for what happens in a realistic situation.

By separating the relevant literature in different topics, such as separation mechanism(s), phases, types of experiments and final results, we will provide some guidelines to address areas where possible advances can be achieved to take us closer to producing an ideal membrane-based molecular separation system.