

Polymers In Confinement

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All forms of chromatography involve methods in which polymer confinement governs the separation process, either by the partitioning of polymers between the free and confined regions in the limit of slow fluid flow or because of the difference in flow properties of polymers in these regions for processes with strong flow. The theoretical treatment of polymer partitioning between mobile and free regions has for the past 40+ years followed the classic methods of eigenfunction expansions and the use of long chain (ground state dominance). These eigenfunction methods encounter technical difficulties when considering the dependence on the full range of molecular weights, the influence of interactions with the confining surfaces, and the need to evaluate the average of flow properties, such as the drag force, over the configurations of the confined chains. We have implemented an alternative theoretical approach that utilizes Greens function methods and recent advances with numerical inverse Laplace transforms to approach problems of describing the influence of chain branching and polymer-surface interactions on the confinement probabilities, the analysis of a commonly used method for deducing pore sizes, and the recent methods introduced by Wu and coworkers for separating linear and branched chains.