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Ultra-high Burst Strength of CVD Graphene Membranes LUDA WANG, MICHAEL BOUTILIER, PIRAN KIDAMBI, ROHIT KARNIK[1], Massachusetts Institute of Technology, MICROFLUIDICS & NANOFLUIDICS RESEARCH LAB TEAM — Porous graphene membranes have significant potential in gas separation, water desalination and nanofiltration. Understanding the mechanical strength of porous graphene is crucial because membrane separations can involve high pressures. We studied the burst strength of CVD graphene membrane placed on porous support at applied pressures up to 100 bar by monitoring the gas flow rate across the membrane as a function of pressure. Increase of gas flow rate with pressure allowed for extraction of the burst fraction of graphene as it failed under increasing pressure. We also studied the effect of sub-nanometer pores on the ability of graphene to withstand pressure. The results showed that porous graphene membranes can withstand pressures comparable to or even higher than the >50 bar pressures encountered in water desalination, with non-porous CVD graphene exhibiting even higher mechanical strength. Our study shows that porous polycrystalline CVD graphene has ultra-high burst strength under applied pressure, suggesting the possibility for its use in high-pressure membrane separations.

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