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# Analysis of the Detachment of Water Droplets from a Porous Fibrous Surface

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**Abstract :** The growth, deformation, and detachment of fluid droplets adherent to solid substrates is a problem of fundamental interest with numerous practical applications. Specific interest in this proposal is the problem of a droplet on a fibrous, hydrophobic substrate subjected to body or external forces (gravity, convection). The past decade has seen tremendous advances in proton exchange membrane fuel cell (PEMFC) technology. However, there remain many challenges to bring commercially viable stationary PEMFC products to the market. PEMFCs are increasingly emerging as a viable alternative clean power source for automobile and stationary applications. Before PEMFCs can be employed to power automobiles and homes, several key technical challenges must be properly addressed. One technical challenge is elucidating the mechanisms underlying water transport in and removal from PEMFCs. On the one hand, sufficient water is needed in the polymer electrolyte membrane or PEM to maintain sufficiently high proton conductivity. On the other hand, too much liquid water present in the cathode can cause 'flooding' (that is, pore space is filled with excessive liquid water) and hinder the transport of the oxygen reactant from the gas flow channel (GFC) to the three-phase reaction sites. The aim of this work is to investigate the stability of a liquid water droplet emerging form a GDL pore, to gain fundamental insight into the instability process leading to detachment. The approach will combine analytical and numerical modeling with experimental visualization and measurements.

**Keywords :** polymer electrolyte fuel cell, water droplet, gas diffusion layer, contact angle, surface tension
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