Light exploring life
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Transient, spatially resolved desaturation of gas diffusion layers measured via synchrotron visualization

The transient 3-D visualization of the desaturation process of flooded gas diffusion layers (GDLs) is presented for the first time. On-the-fly Synchrotron X-ray CT is performed while the GDL sample is subjected to a humidified or dry air flow stream to visualize the transient desaturation. The two humidification conditions assist in separating the convective and evaporative components of the desaturation process, showing a slight contribution from the convective effect, while the majority of the desaturation is due to evaporative removal. The convective removal is found to be insufficient to fully desaturate either GDL, with water remaining trapped underneath the channel rib with the more hydrophobic GDL and within the pore space in the more hydrophilic GDL. Step-and-shoot Synchrotron X-ray computed tomography (CT) is then used in conjunction with program-assisted segmentation to determine initial saturation water volumes. These are then combined with the desaturation times found from the on-the-fly experiments to determine desaturation rates for both GDLs. The desaturation rate using dry air flow for the more hydrophobic GDL is found to be nearly four times faster than that of the more hydrophilic GDL. Results demonstrate that an evaporative contribution is necessary for either GDL sample to reach full desaturation.

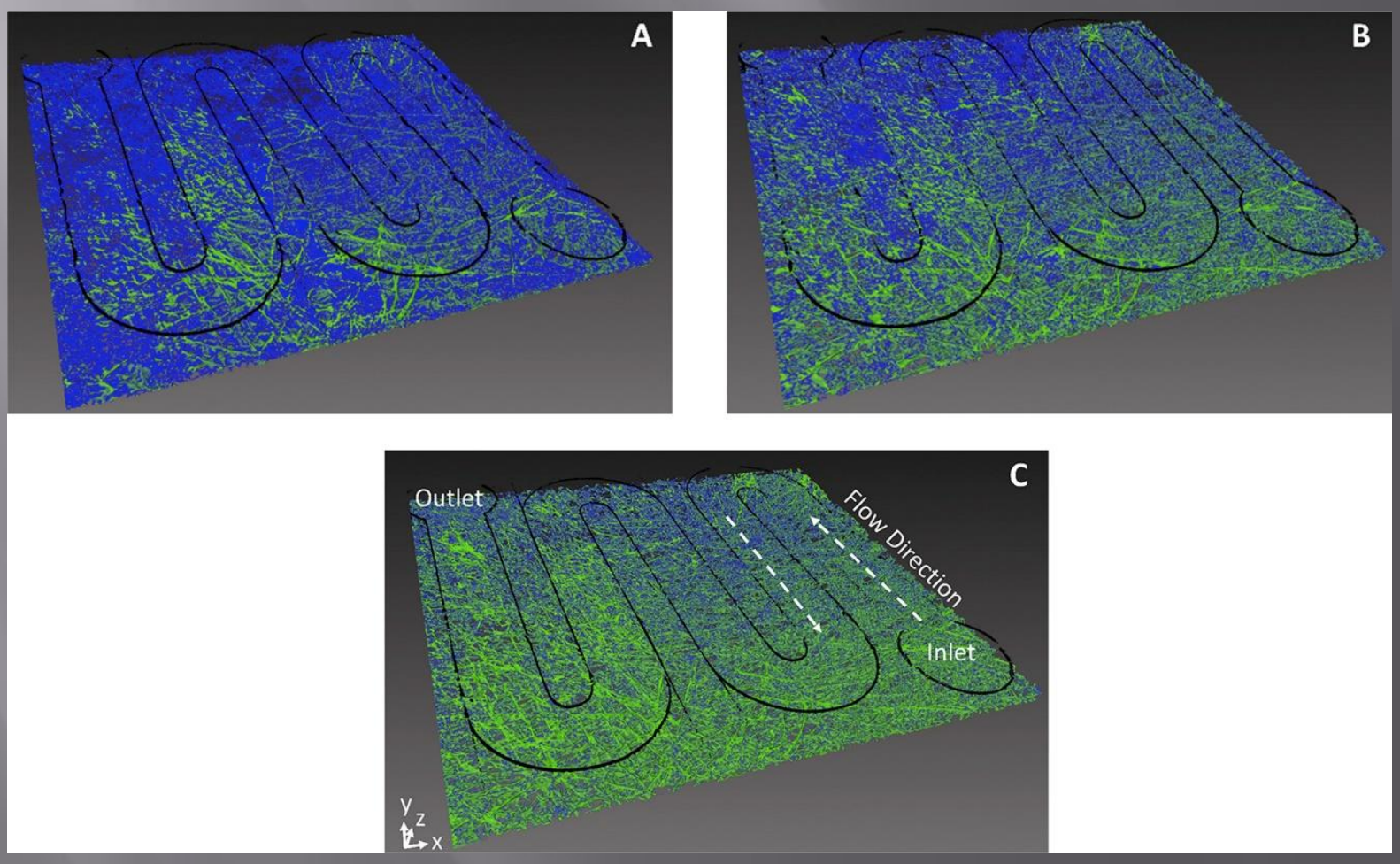

Figure. Visualization of desaturation process with dry air with the 25 AA GDL where blue represents water and green represents GDL fiber. A) Initial saturation 25 AA, B) saturation after 8.5 min, C) final saturation after 16 min.