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PIV Measurements of Turbulent Flow Over a Permeable Wall using a Refractive-Index Matching Approach T. KIM, G. BLOIS, J.L. BEST, K.T. CHRISTENSEN, Univ. of Illinois — Turbulent flows over permeable walls occur in a variety of natural environments and engineering applications. Unlike classical and widely-studied flows over impermeable walls, the peculiar dynamics of flow generated by permeable walls are poorly understood. Early studies suggest that the well-known higher energy dissipation induced by permeability (as compared to impermeable walls with similar roughness) can be explained by unveiling the flow interactions within the transition layer that forms at the interface between the overlying flow and the permeable wall. To overcome the challenges associated with quantifying the flow character both above and within a permeable wall, a Refractive-Index-Matching (RIM) approach was employed. Doing so facilitated optical access to the fluid flowing through the permeable wall, thus yielding direct PIV pore-space flow measurements within the transition layer. The permeable wall was formed by packing acrylic spheres in a cubic arrangement and was then immersed in an aqueous solution of sodium iodide at a concentration and temperature that ensured accurate refractive index match with the wall. Measurements were focused on the flow across the wall interface and the turbulent attributes of these surface–subsurface interactions were detailed.

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