In polymer electrolyte fuel cells (PEFCs), there exists a trade-off between the compression pressure on the porous media and mass transport. For an adequate seal and low electrical contact resistance, a high compression is desired. However, over compression can result in restriction of mass transport and plastic deformation of the highly porous media. The motivation of this work was to understand the impact of cell compression on performance and to measure electronic resistance using a specialized diagnostic cell with capabilities for rapid compression pressure adjustment. The graphite single-path serpentine fuel cell flow-field plates were complemented by a bladder system that enabled rapid change of compression pressure across the flow-field. Humidified air and neat H₂ were used as the reactants, and the cell temperature was controlled at 80 ºC with a recirculating water bath. A fully automated Arbin fuel cell test stand was used to operate and record data. Two tests were conducted: the first at 100% relative humidity and the second at 50% with the following conditions identical: cell temperature of 80 ºC, back pressures on the anode and cathode outlets of 15 psi, and anode and cathode stoichiometries of 2.
Polarization curves taken at different compression pressures were compared, and it was determined that increased bladder pressure decreases performance in the range of 32-80 psi bladder pressure. The kinetic and mass transfer regions of the polarization curve were affected in addition to the ohmic region. Overall, this study showed that clamping pressure can impact fuel cell performance. Ongoing study will evaluate the impact of compression on water management and on ohmic losses to clarify the trend illustrated in this study further.