**Performance of Planar SOFC Stacks at Elevated Pressure**

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Increased efficiency can be achieved by operating solid oxide fuel cell (SOFC) stacks at elevated pressure; however, sealing in planar solid oxide fuel cell (SOFC) stacks is challenging. Gas leakage can occur due to small pressure differentials (2-3 psi) between the process flows and external atmosphere, and this adversely affects fuel cell performance and lifetime.  A 60-cell, planar SOFC stack was operated up to 45 psia with the pressure differentials minimized by containing the stack in a pressure vessel and regulating back-pressure for each of the three zones (anode, cathode, and vessel).  At 30 psia, the absolute efficiency increase was shown to be 1.2%, which extrapolates to at least a 2% increase at 45 psia and is in agreement with other recent studies on pressurized planar SOFC stacks.  Both Nernstian and kinetic effects were found to be responsible for enhanced fuel cell performance at elevated pressure.