Power Generation from Solid Fuels in a Solid Oxide Fuel Cell with a Molten Antimony Anode

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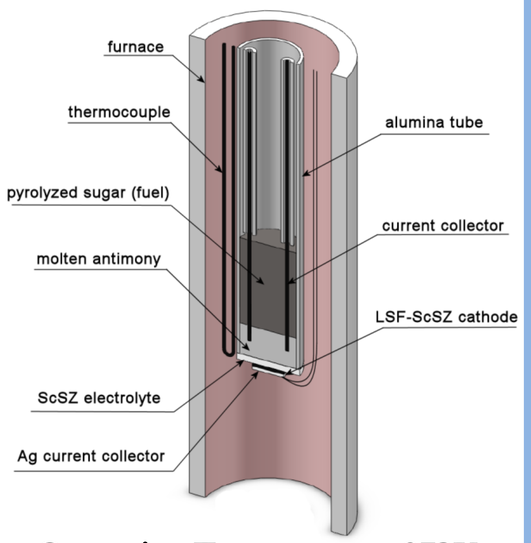
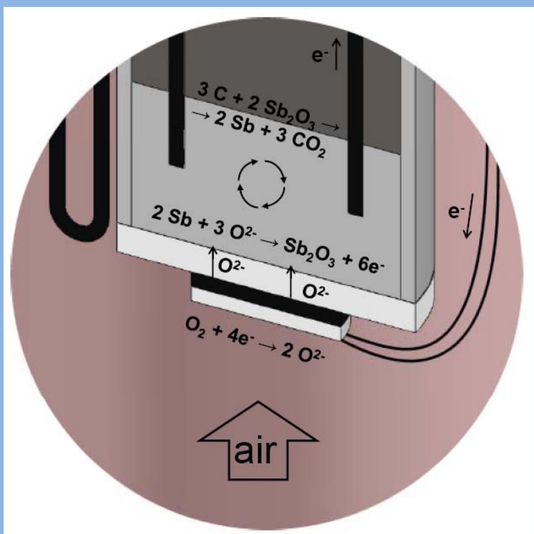
Objective: To enable facile oxygen transfer to solid carbonaceous fuel (i.e. coal, biomass) from an SOFC electrolyte using a molten antimony anode.

Experimental Setup



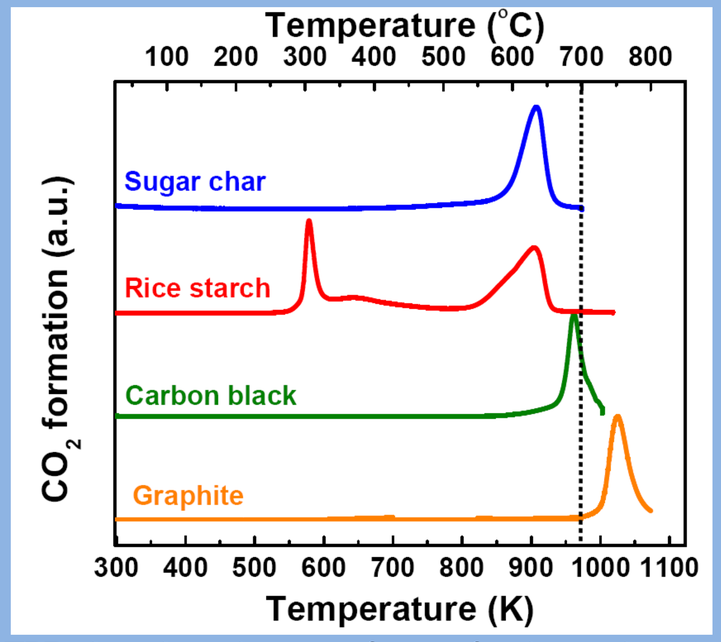
Operating Temperature: 973K

Reactions involved



Key Characteristic: Sb (m.p. 903K) and Sb_2O_3 (m.p. 929K) are both molten phases.

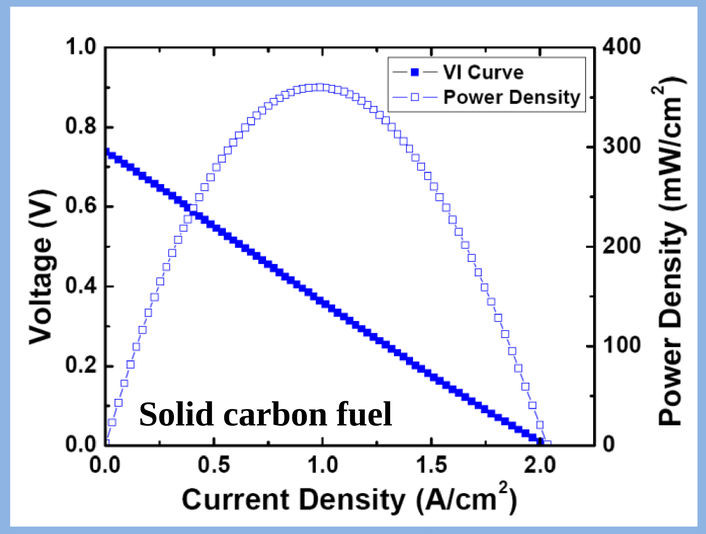
Fuel Flexibility



TPR plots show that most forms of carbon reduce Sb_2O_3 below the operating temperature of 973K.

Performance on par with H_2-SOFCs

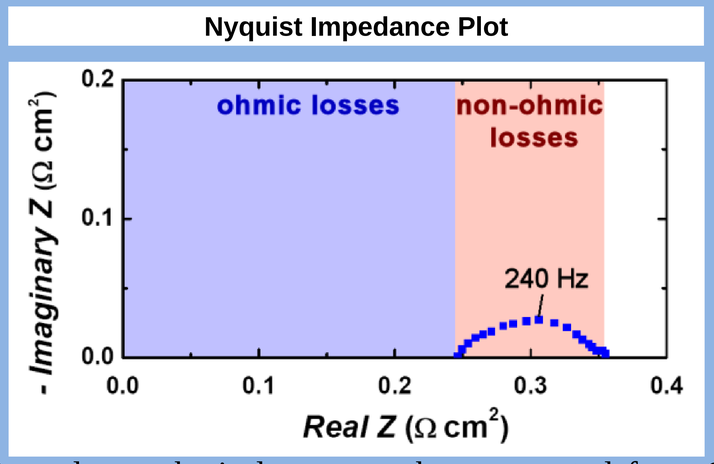
Sb anode with sugar char as fuel



Open Circuit Voltage = 0.75V for Sb/Sb_2O_3 system.

Max. Power Density: **360 mW/cm²**

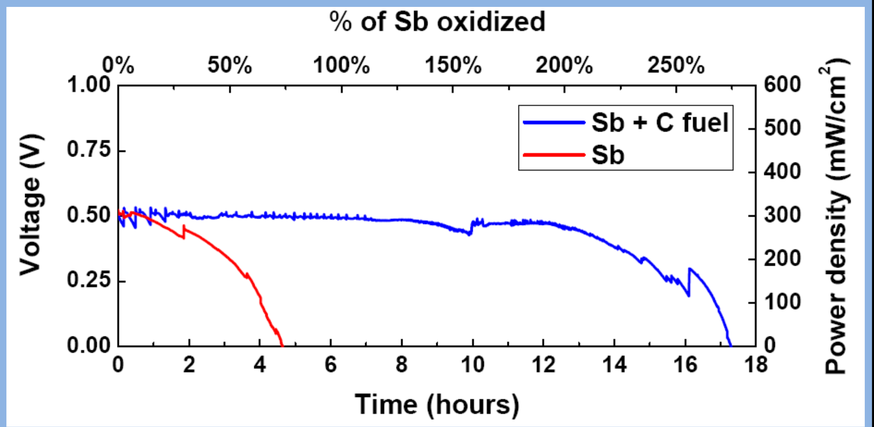
Very Low Anode Impedance



Ohmic and non-ohmic losses are those expected from ScSZ electrolyte and LSF-ScSZ cathode respectively.

► **Sb Anode Impedance ≈ 0**.

Demonstration of Carbon Fuel Consumption



Sb in C -fueled anode underwent two turnovers at a power density of 300 mW/cm² before all the fuel was consumed. Without C fuel the anode performance falls due to Sb_2O_3 accumulation.

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