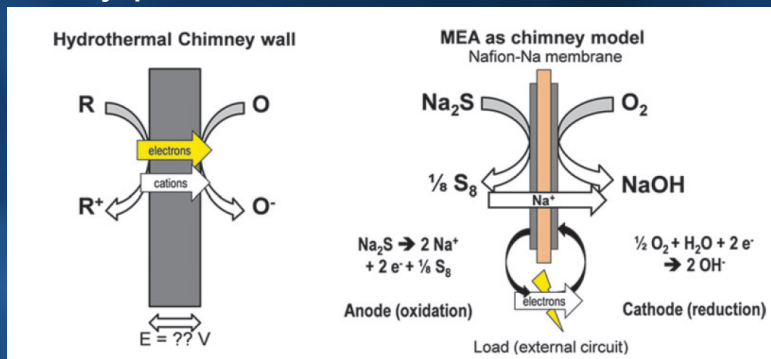


Simulating Hydrothermal Vent Environments

Seafloor hydrothermal vents on the Earth allow life to thrive off geochemical energy, and are likely to be present on ocean worlds in the outer solar system, where they may provide habitable environments where there is less energy from the sun.

- Vents are natural systems that can be modeled and studied as fuel cells, and experimental techniques have proven successful to simulate the redox chemistry of a black smoker vent on Earth as a primary step to simulating other types of vents and the energy they may produce for life.



Left: Fuel cell conceptual model for a vent.

Right: Process for making a geological sample (hydrothermal minerals) into electrode ink that can be painted onto a fuel cell electrode assembly. (*This mineral sample was generously provided by JAMSTEC, collected at the KY14-01 Cruise.)

- Using assemblies where the electrodes were “painted” with natural rock and mineral samples, these fuel cell model systems show that these surfaces can abiotically catalyze redox chemistry in vent systems, which, in vent systems, would determine which substrates might be available to life. Using well-conceived fuel cells as vent simulators can be an effective process for evaluating geological environments containing redox-active minerals, allowing for evaluation of energy present in a variety of astrobiologically relevant systems.

