Power Output, Microstructure, and Microchemical Analysis of High Surface Area Pd and Ti Cathodes Obtained by Thermal Treatment

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Palladium and titanium foils were heated over a Bunsen burner flame to obtain a topography with a high surface area to volume ratio in the resulting metal oxide. These microstructures are hypothesized to form via spinodal decomposition [1 - 5], rather than classical recrystallization and grain growth. For metals that can undergo significant sorption of hydrogen isotopes, an increased surface area naturally leads to an increased hydrogen (and/or deuterium) loading capacity. Electrolysis experiments conducted in acidified, either light or heavy water, using the heat treated metal cathodes, showed anomalous elements, including V and Fe, from Ti cathodes after heat treatment and electrolysis. Fig. 1 shows a typical network of bright particles interspersed within a dark phase. The bright particles contain less palladium and more oxygen than the darker phase. Following electrolysis, anomalous Ag was detected in the center of the dark pit on the Pd cathode shown in Fig. 2. Power output from electrolysis with a heat treated Pd cathode will be compared with that from electrolysis with a Pd cathode in the cold rolled condition.

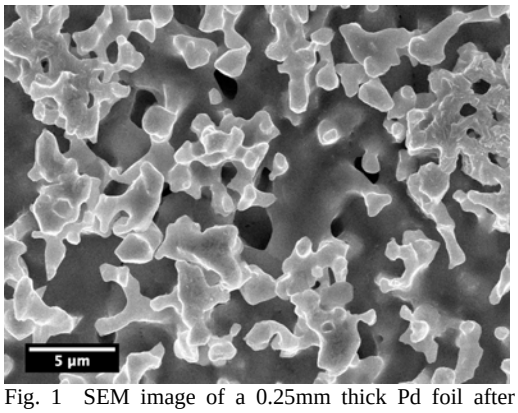

Fig. 1 SEM image of a 0.25mm thick Pd foil after being cold rolled and heated 40 minutes over a Bunsen burner flame.

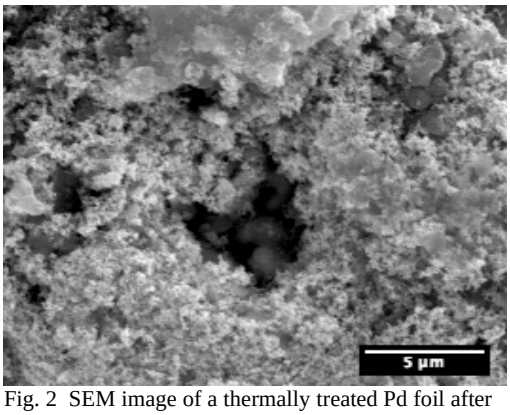

Fig. 2 SEM image of a thermally treated Pd foil after electrolysis. The porous microstructure is largely covered by platinum that had been electrodeposited from the anode.

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