

## V.A.8 Montana Palladium Research Initiative: Detection of Trace Platinum Group Element Particulates with Laser Spectroscopy\*

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Project Start Date: August 31, 2006  
Project End Date: December 31, 2007

\*Congressionally directed project

- Reduce Emissions (combined gas and particulate) to <1.5 grams/1,000 kWhr.

### Accomplishments

- The project is just getting started. The laser system and spectrometer have been ordered.
- The particle generator components have been ordered.

### Approach

The approach taken is to develop the established and proven technology of LIBS specifically to study PGE-particulate emission from fuel cells. This direct approach will result in a versatile, sensitive, real-time, and potentially *in situ* diagnostic technique to evaluate PEMFC particulate emissions.

### Results

Since the project is just beginning, there are no results to report at this time.

### Conclusions and Future Directions

During FY 2007, major research equipment was ordered and is awaiting arrival. Tasks to be accomplished during the remainder of FY 2007 are:

- By August, the construction of the particle generator and set-up of the LIBS experimental arrangement will be completed. Also, calibration the LIBS signal using known PGE standards will begin.
- By September, complete the calibration phase of the project by establishing the relationship between PGE particle mass flow rate in the aerosol stream and the intensity of LIBS signals.
- After installation on the MSU-Billings campus of the fuel cell units in early fall, begin LIBS experiments to analyze PGE particulates in membranes and filters from operating fuel cells.

### References

1. D. W. Hahn, J. E. Carranza, and G. R. Arsenault, Review of Scientific Instruments 72, 3706 (2001).

### Objectives

- Develop laser-induced breakdown spectroscopy (LIBS) to detect and characterize nanoparticles of the platinum group elements (PGEs).
- Use LIBS to quantify nanoparticles of PGEs in proton exchange membrane fuel cells (PEMFCs) filters and membranes.

### Technical Barriers

This project addresses technical barriers from the Fuel Cells section of the Hydrogen, Fuel Cells and Infrastructure Technologies Program Multi-year Research, Development, and Demonstration Plan:

- (A) Durability
- (C) Performance
- (G) Startup and Shutdown Time and Energy/Transient Operation

### Technical Targets

The technology developed by this project to detect and characterize emissions of PGE nanoparticles will support the following DOE 2011 Technical Target (Table 3.4.4).