

VI.C.3 Electron Charged Graphite-based Hydrogen Storage Material

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Subcontractor:

Superior Graphite Co., Chicago, IL

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Projected End Date: June 30, 2009

Objectives

- Expansion of the graphite layers and generation of small particles to allow access for hydrogen adsorption.
- Metal intercalation in the graphite layers to increase back-donated electron charges onto the carbon, so the hydrogen adsorption becomes combined physisorption and chemisorption.
- Addition of electron charge in the process of the hydrogen filling to increase hydrogen storage and charge and discharge cycles.

Technical Barriers

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

- A. Cost
- B. Weight and Volume
- D. Durability
- E. Refueling Time

Technical Targets

The Gas Technology Institute (GTI) and Superior Graphite Company have teamed to develop a new concept for new materials to store hydrogen on-board vehicles and for other applications based on low-cost natural flake graphite materials with modifications. An effective hydrogen storage system for transportation applications requires quick charge and discharge, high wt% storage capacity with small volumes, durability over many cycles, and safe handling and transport. The challenge is to develop novel materials that reach the year 2010 DOE storage capacity goal of 6.0 wt% (system) and that are strong, reliable, and low-cost.

Approach

Select graphite and study graphite expansion and intercalation conditions

The goal is to prepare specially processed graphite materials and modify their structure. GTI and Superior will select from many available natural flake graphite materials and metal candidates. Superior will process and prepare various samples of the modified graphite with intercalated metals. Several specially modified graphite types, particle sizes, and compositions will be prepared for tests. Different shapes of the graphite particles may affect hydrogen storage capability. GTI and Superior will explore natural and synthetic graphites with different shapes and characteristics that are favorable for hydrogen storage.

Construct an electron charge device and evaluate the GTI electron charge concept with the modified graphite materials over a range of parameters

We will construct an electron charge device, with applied voltage measurements, and the appropriate necessary insulated sample holders. Measurements of the hydrogen storage amount versus the charge (charge device voltage) will be made. Moisture, temperature, and gas composition will be measured during the multiple trials with several samples. The temperature changes upon fill and discharge will be measured to assess thermal management needs for a practical device.