

FLORIDA SOLAR



ENERGY CENTER

Hydrogen Detection Using “Smart Pigments & Paints”



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Relevance to NASA

Detecting H₂ leakage at storage or usage sites is crucial for safe NASA operation



Approach

- To develop functional materials that reveal, in an “easy-to-see” & practical manner, the presence of hydrogen due to minute gas leaks
 - One Time-Use (Irreversible)
 - TiO₂/PGM pigment
 - Advance from TRL3 to TRL4 & TRL5
 - Repeated-Use (Reversible)
 - Tungsten/Pt (Pd) pigment
 - Advance from TRL1 to TRL2 & TRL3

Project Timeline

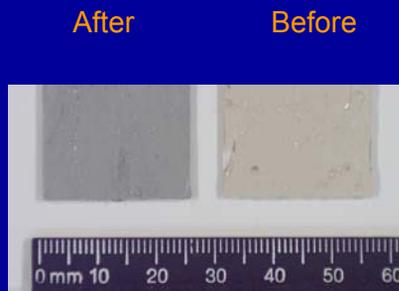
Project Steps:	Qtr 1			Qtr 2			Qtr 3			Qtr 4		
	Sep 04	Oct 04	Nov 04	Dec 04	Jan 05	Feb 05	Mar 05	Apr 05	May 05	Jun 05	Jul 05	Aug 05
Process application of PGM oxides	[Red bar with star icon]											
Synthesis of reversible pigments					[Purple bar]							
Physicochemical characterization of reversible					[Blue bar with green dot]							
Weathering					[Yellow bar with black arrow]							

Accomplishments

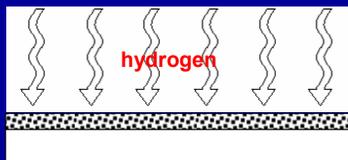
- Identified special metal oxide based powders for “one time-use” that can be synthesized inexpensively.
- Identified special tungsten-based pigment for “repeated-use” application.
- Identified special gas permeable matrix for pigment protection and application.
- Different techniques for application of the pigments have been tested.

Gas Permeable Matrix

- Environmental protection - ultraviolet, -40°C, HCl and hydrazine exposure
- Improved selectivity to H₂ with CO exposure



Gas Permeable Matrix Tailored Behavior with Overcoating

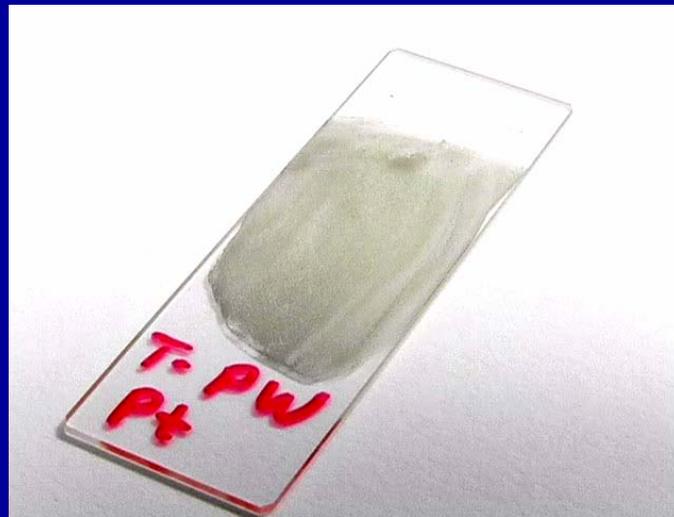


silicone plus
PdO/TiO₂
clear
silicone



Enhanced Reversible Chemochromic Hydrogen Sensor

- Background
 - WO₃/PMG – Rapid Reaction if Moist
- Novel System
 - TiO₂/PMG/H₄[SiW₁₂O₄₀]
 - Rapid Reaction Dry
 - Rapid Recovery



Future Activities

- Lab Tests
 - Effect of other dopants to enhance color change for irreversible pigment.
 - Physicochemical characterization of reversible pigment.
- Field Tests

Publications & Patents

- A provisional patent has been just filed with the USPTO entitled “GAS PERMEABLE CHEMOCHROMIC COMPOSITION FOR HYDROGEN SENSING”