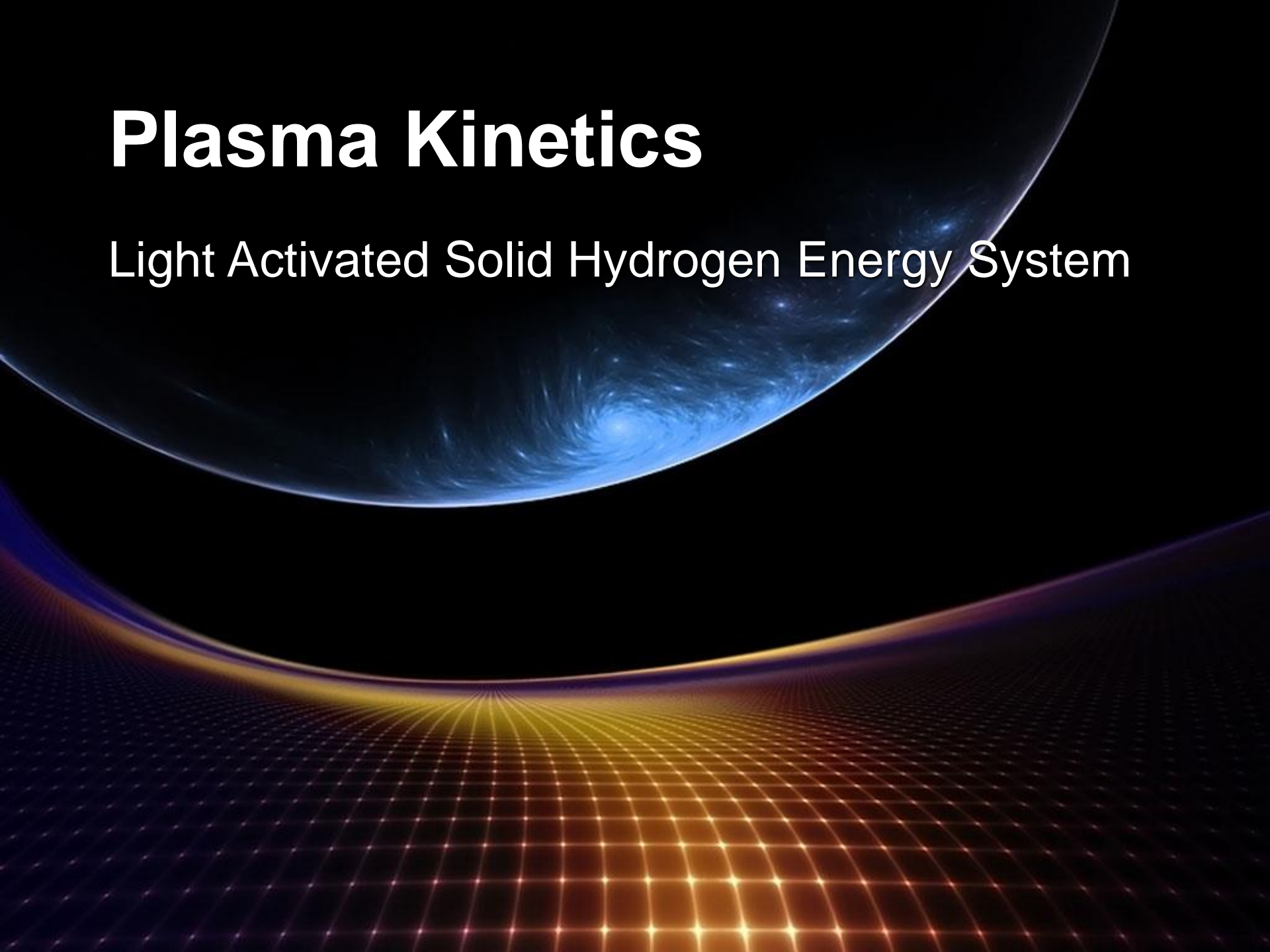


Plasma Kinetics

Light Activated Solid Hydrogen Energy System





Technology

- Light activated hydrogen energy storage
 - More economical than batteries
 - More energy than batteries
 - Lighter than batteries
 - Smaller than batteries
 - Zero emission generation of energy
 - 100% recyclable vs. battery 4% recyclable



Technology Advantages

- Stored energy released with light.
- No pressurization, non-flammable, long shelf-life, rechargeable, light weight and 100% recyclable
- Quick recharging
 - (< 1 hour) and hot swappable/HRR in 5 minutes
- Multiple fuel recharging sources
 - Municipal waste-water treatment facilities
 - Municipal incineration facility or burn pit
 - Potable water electrolysis
 - Industrial hydrogen production



Value

- 100% Clean Energy
- Minimal Footprint
- Safe
- Economical
- Transportable
- Quiet
- Hundreds of Recharges
- 100% Recyclable

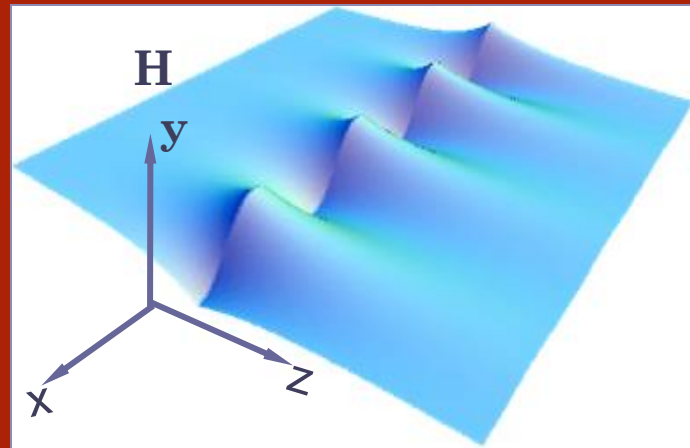
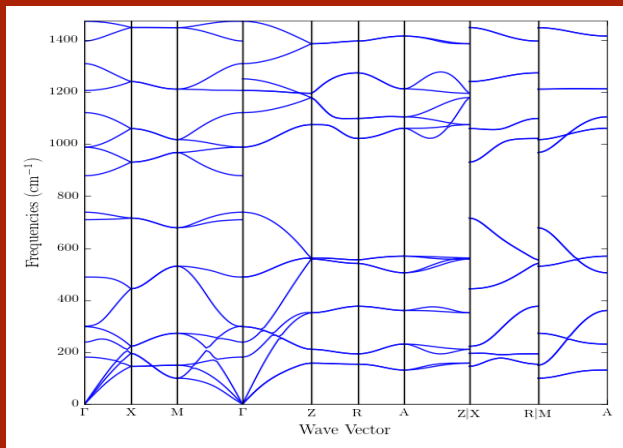


History

- Based on 50 years of metal hydride research
- Patented in 2007
- Patent granted 2018 (after 10-year security restriction)
- Innovation based on photonic properties of magnesium and manganese hydrides
- Application includes metal doping and shape memory alloys of nickel, titanium and copper
- Applied edge surface and resonance cavity nanostructures included to \uparrow plasma polariton $f(x)$ and reduce ΔH°

How it Works

Photon Dispersion

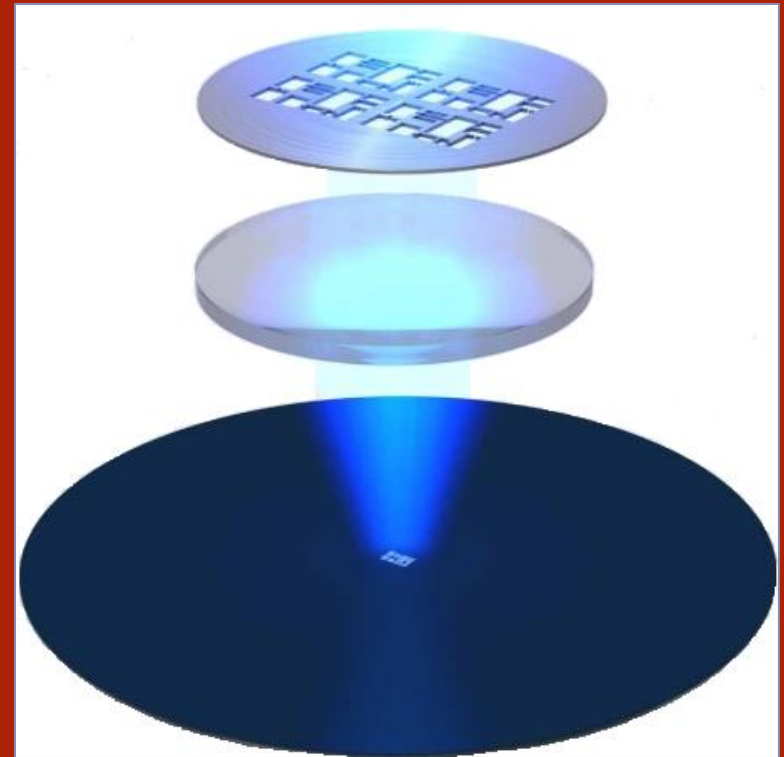


Angstroms thick shape memory alloy layers and metal hydride nanostructures provide a dielectric with black state forming constituents and lower bond energy. Photon absorption and polariton resonance support dissociative amplitude energies when exposed to photonic irradiation.

The result is safe, efficient, high-density, photo-reactive, solid-state hydrogen energy storage.

Fabrication

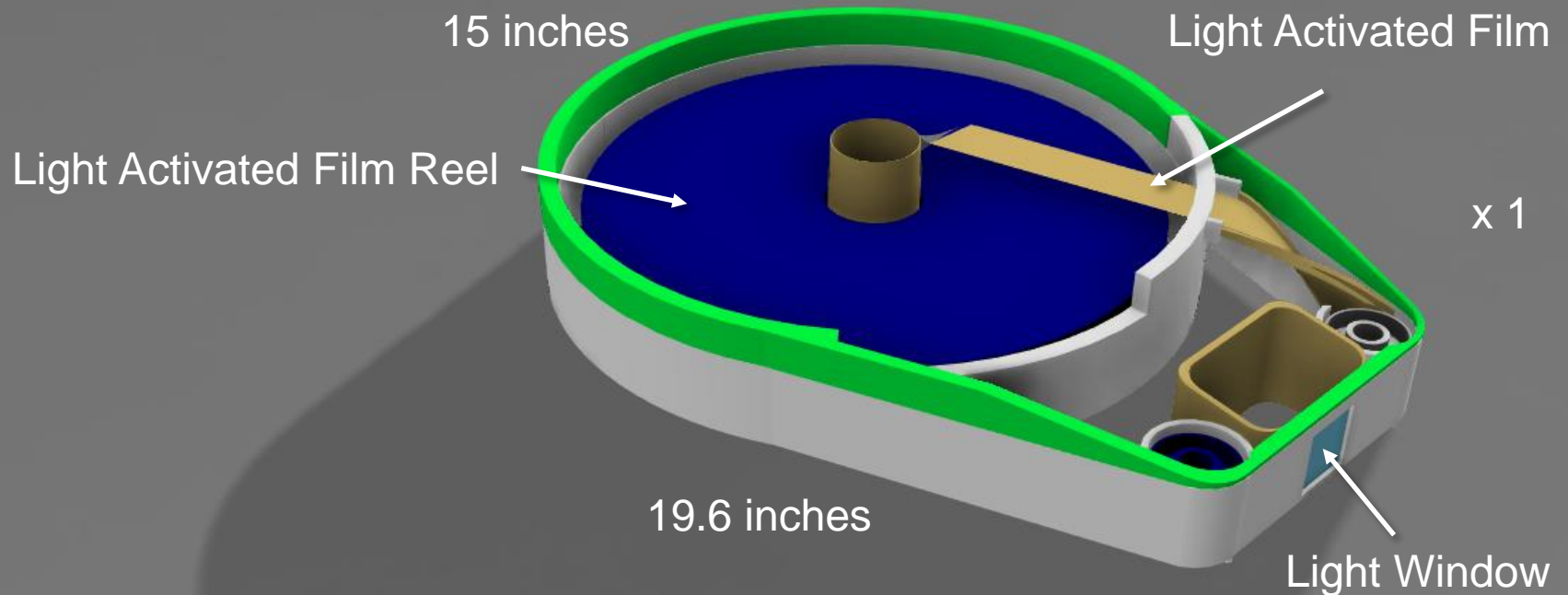
- A lithographic layered nano-structure deposition creates semi-conductive electrical properties
- Thin film reel, compact disc and other substrate format options available depending on application



Thin Film System (Mobile)

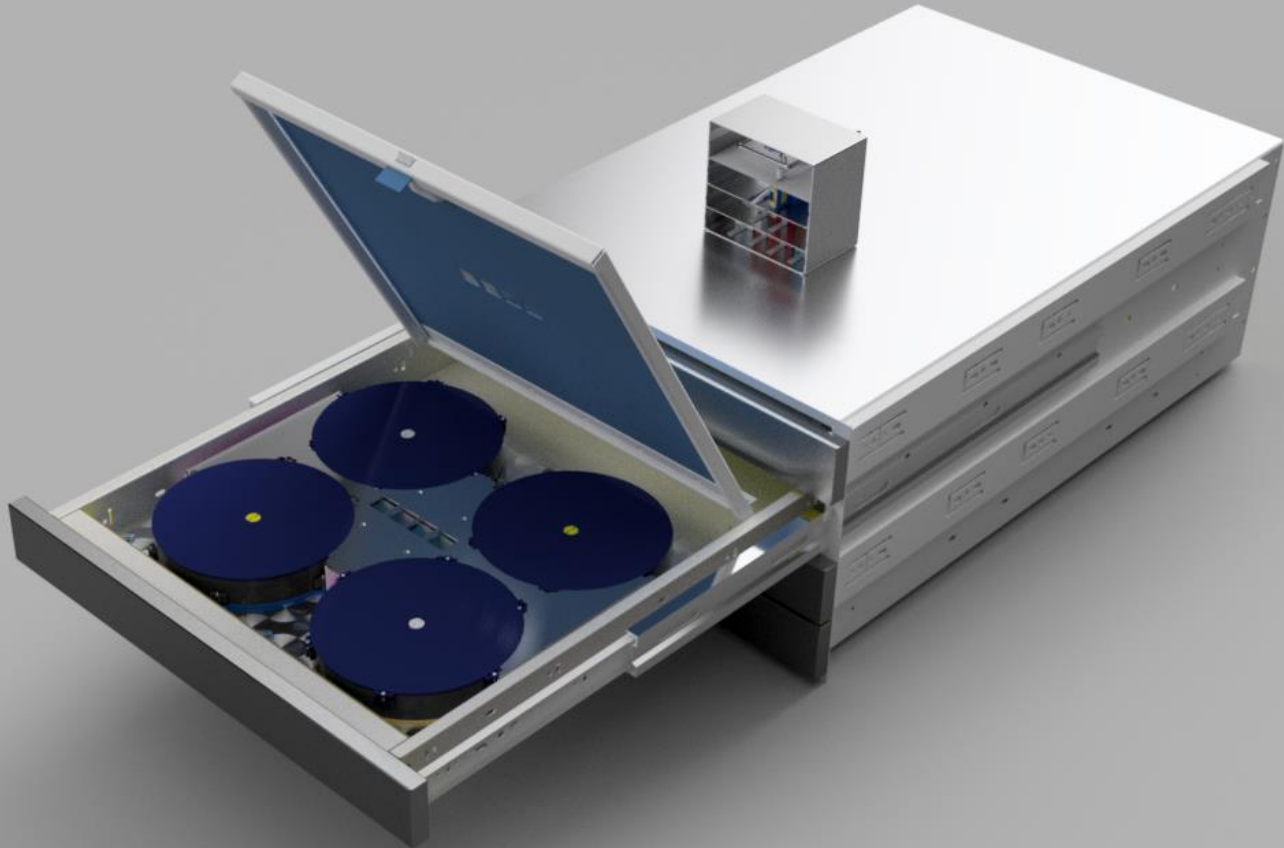


Film System Components



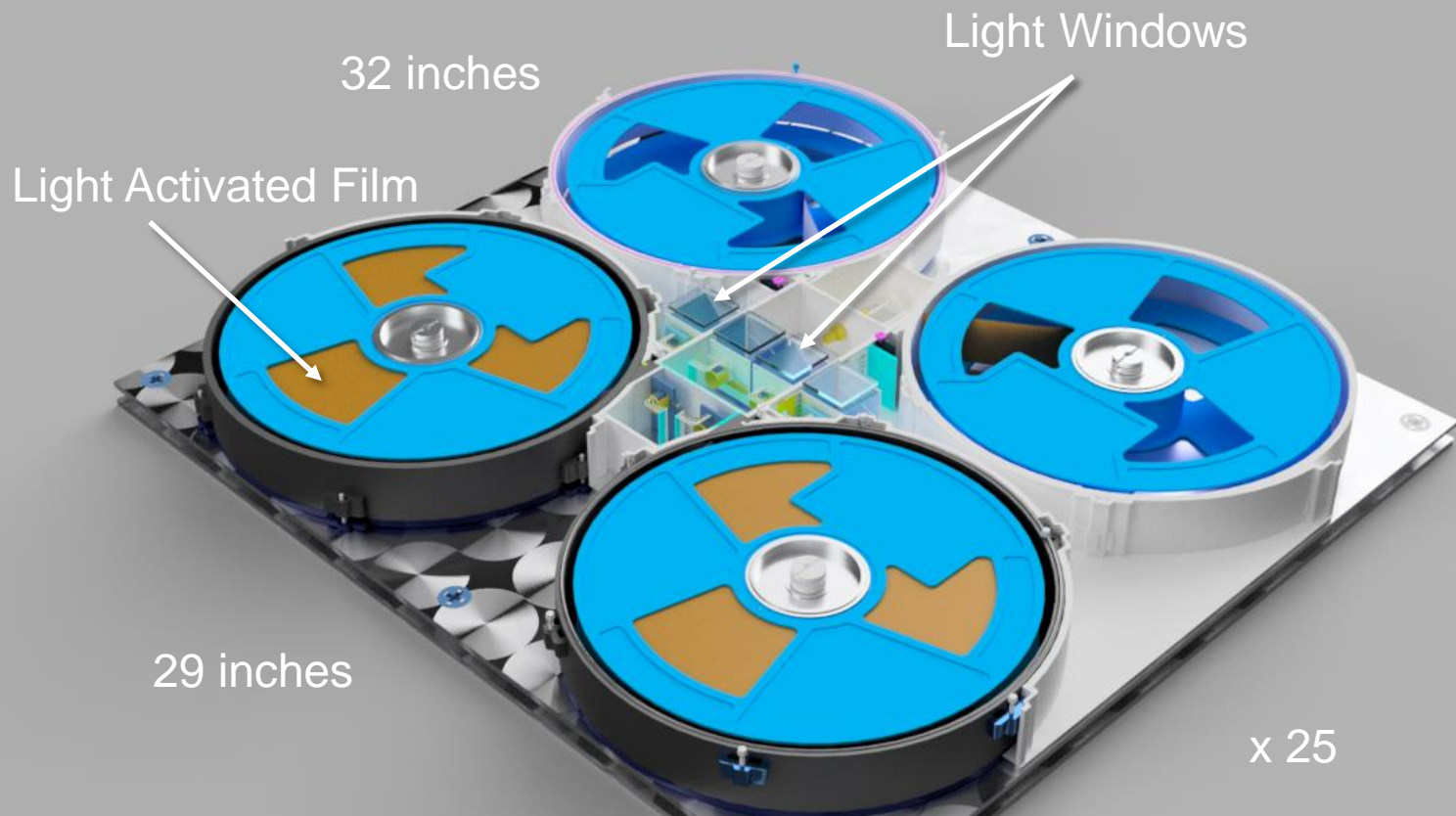
18-pound mobile unit with 252 grams of hydrogen → 5.5 kWh

Thin Film System Stationary



Stationary System Internal

1000-pound standing unit with 12 kg of hydrogen → 270 kWh

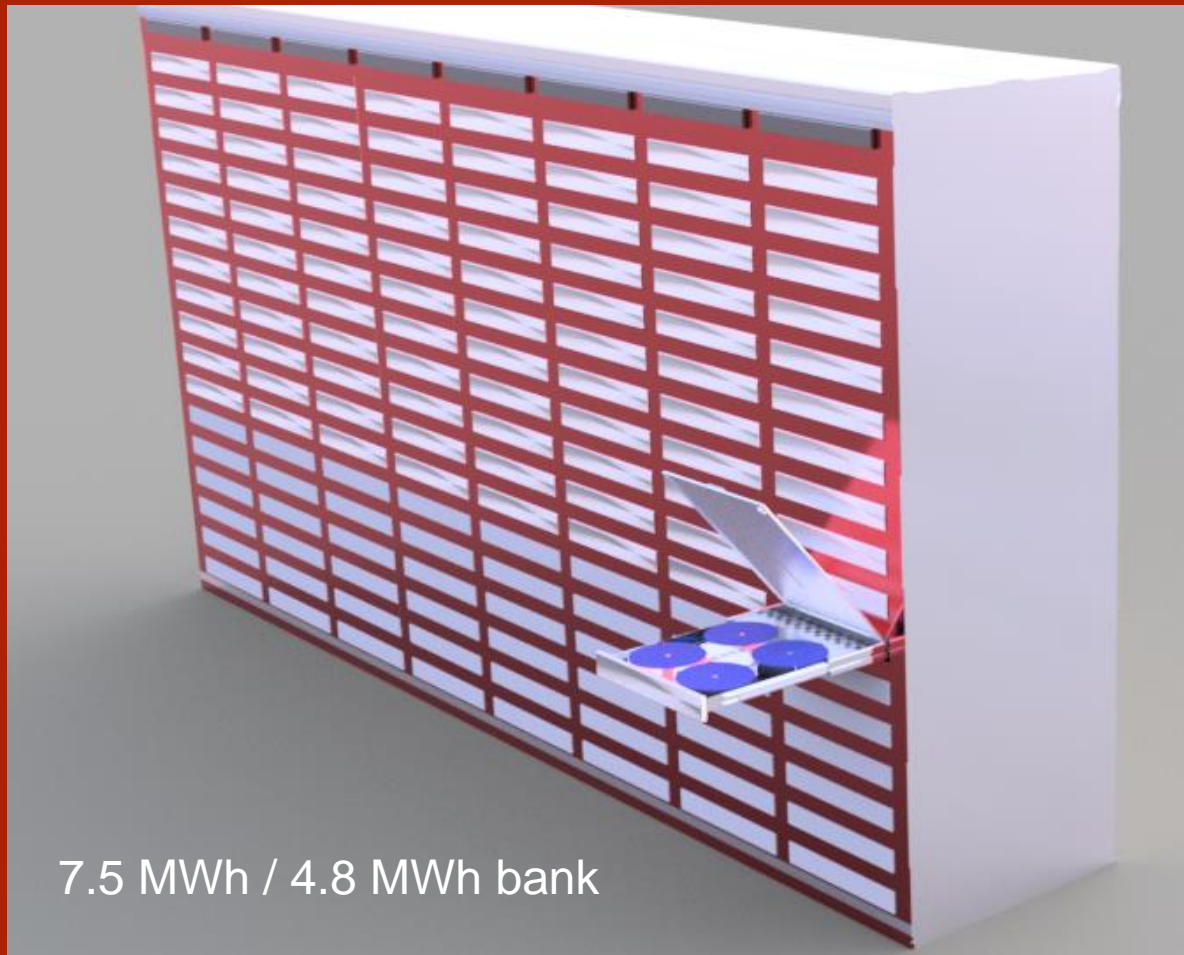




Specifications

- Gravimetric energy density
 - Material 6.5 wt% H₂ → 2166 Wh/kg
 - System (mobile) 3.1 wt% H₂ → 1033 Wh/kg
 - Available energy density → 220/670 Wh/kg
- Volumetric energy density
 - Material → 3672 Wh/l
 - System (mobile) → 765 Wh/l
 - Available energy density → 490/515 Wh/l

Application (Stationary)



Application (Stationary)



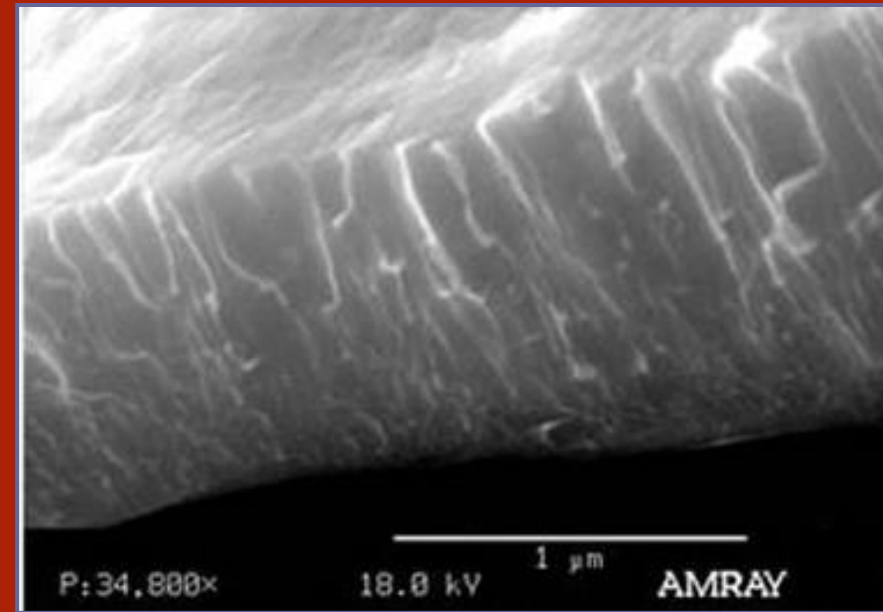
Containerized
15 MWh / 9.75 bank

Film Characteristics

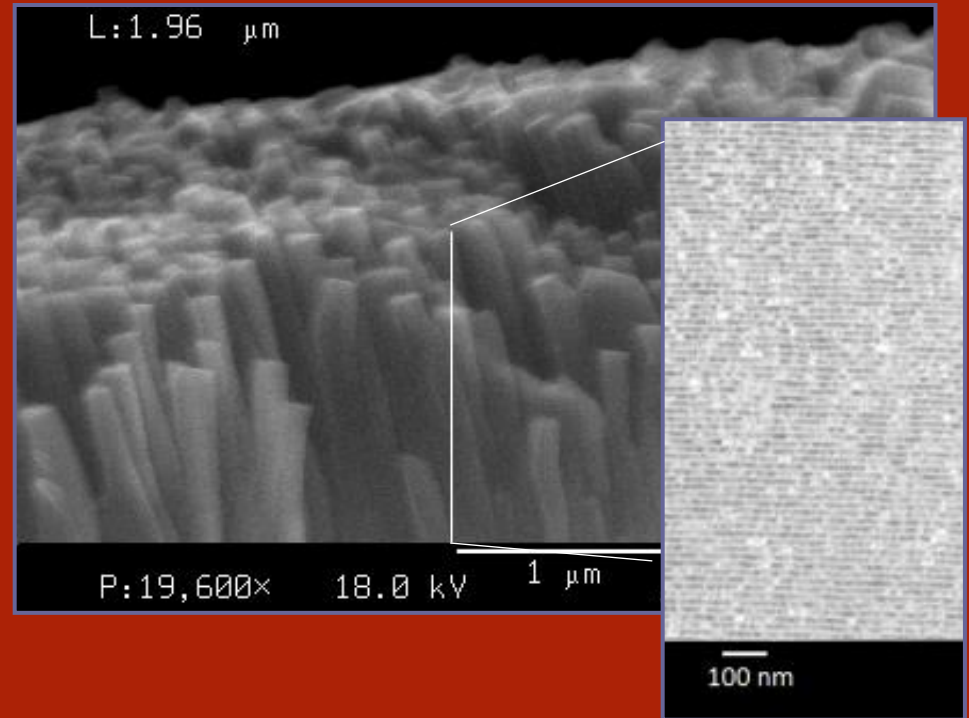


- Film tensile strength 35kg/cm
- Dielectric strength 8,000 volts
- Resistant to crepitation
- Heat resistant
- UL 94 V-0 non-flammable
- Rechargeable without pressure
- H₂ absorption in 60 seconds
- Rechargeable hundreds of cycles
- 100% recyclable
- Separates Protium and Deuterium
- Deuterium captured during recycle
- No rare-earth elements
- Non-toxic
- Resistant to contamination (can absorb H₂ from incineration or coal fired power plant flue gases)

Nano Structuring

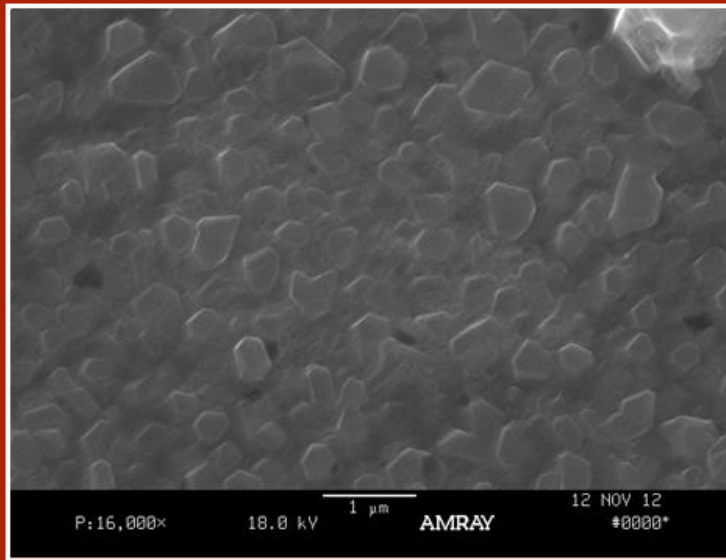


Nano-structured film with 6.5% wt H₂
(scanning electron micrograph)

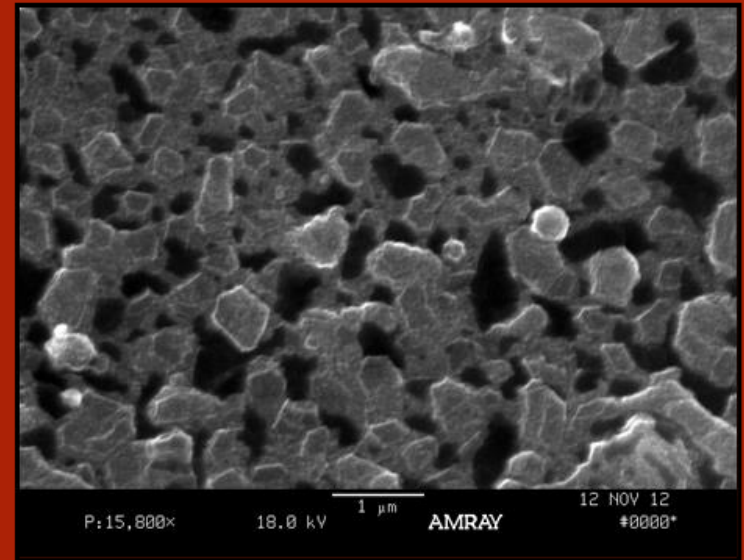


Nano-structured film showing angstroms
thick layers after H₂ desorption
(scanning electron micrograph)
(inset tunneling electron micrograph)

Nano Structuring



Nano-structured film with 6.5% wt H₂
(scanning electron micrograph)



Nano-structured film after H₂ desorption
(scanning electron micrograph)

Value Proposition

Light activated hydride has greater value compared to:

Batteries	Tanked Hydrogen	Tanked Fuels	Diesel Fuel Injection	Unmanned Aircraft	Portable Electronics
200% Longer lasting	1000% lower pressure	5% to 50% lower cost	3% to 12% increased H.P.	Safe fueling and on-board infrastructure	200% Longer lasting
25% lower cost	25% to 80% lower cost	Non-Polluting	10% to 20% better fuel mileage	Electric provides stable platform	25% lower cost
50% lower weight	30% more efficient	Renewable	90% lower CO 50% lower HC	50% lower weight	50% lower weight
100% recyclable	Non-volatile Non-flammable	Non-volatile Non-flammable	Lower exhaust temp Lower noise	200% longer mission duration	Non-toxic and 100% recyclable

Lighter, Less Pressure than Tanked Hydrogen

Half the weight and a fraction of the cost of lithium-ion.

Systems can be made small enough to power a cell phone or large enough to power a ship.



Unique

- Only energy storage method which
 - Reduces green house gases on H₂ absorption
 - Requires no energy or pressure to absorb H₂
 - Can be charged in 60 seconds
 - Releases H₂ with less energy than common hydrides and less energy than is required to pressurize hydrogen.
 - Can commoditize hydrogen from waste-water treatment plants, incineration facilities, smokestacks and fertilizer production

Contact



PLASMA KINETICS

Responsible, Renewable Hydrogen Energy Systems

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