

The NanoHydrogen Generator System

www.h2energyrenaissance.com



What is the NanoHydrogen Generator System?

Source of clean fuel, for any mode of transportation or for electricity production, cheaper by up to 80% than fossil fuels or nuclear power.

- Patented, proprietary nano-technology powered device
- Simultaneous production of:

1. Hydrogen
2. Nanoparticles

- **Ability to sell nanoparticles and hydrogen 90% cheaper than market**
 - Hydrogen costs less than \$1 Gallon of Gas Equivalent
 - Nano-particles market price is \$100 per kilogram
 - Nano-particles can be sold 90% cheaper than market
- **Use hydrogen anywhere energy as needed**
 - Use as a fuel for any mode of transportation
 - Use as fuel to produce electricity
- **Safe**

Problems we solve:

- **Energy market is BIG, EXPENSIVE and DIRTY**
 - China air pollution, nuclear accidents
 - Energy shortages in developing countries
 - Climate change

- **Nano particles are very expensive**
 - Nanoparticles cost \$100 to \$20 million per kilogram

Solution:

- **Highly affordable energy**
- **Clean and Safe**
- **Use anywhere energy is needed**
- **Affordable nanoparticles: turn materials into advanced materials**

What are the economics?

- **Transportation**

- Up to 60% cheaper

- **1 kWh of Electricity**

- Up to 80% cheaper

- **Nano-particles**

- Up to 90% cheaper

- **Up to 4 times cheaper than retail hydrogen**

Market for hydrogen and for nanoparticles



Hydrogen product



Hydrogen for cars and transport

- \$2+trillion worldwide

Electricity generation market

- \$2+ trillion market

Current hydrogen market

- \$120 billion market

Nanoparticle product



Current nanoparticles market

- \$6 billion



5 year
growth

Nanoparticles market in 2022

- \$25 billion

NanoHydorgen Generator: Hydrogen



Fuel cell



Industrial and home boiler



Car sized hydrogen engine & industrial CHP

Direct uses

CARS, BUILDINGS, TRUCKS, HOMES



FACTORIES, SHIPS, FARMS



CARS, HOMES, TRUCKS, SHIPS



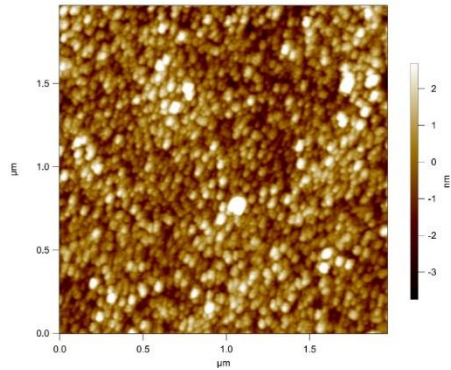
GAS STATIONS, HEATING



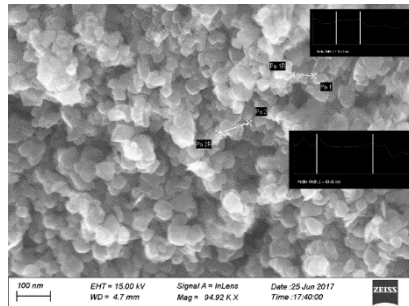
NanoHydorgen Generator: Nanoparticles

- **Methodology to produce nanoparticles from majority of metals up to 90% cheaper than available technologies**
- **Nanoparticles turn materials which represent over \$2 trillion of the global economy annually into advanced materials by improving their qualities**
- **Nanoparticles, tested by University of Louisville nanotechnology research laboratory and California State University, Los Angeles nanotechnology laboratory**
- **H2 Energy Renaissance produced the following nanoparticles**
 - Aluminum Oxide
 - Iron Oxide
 - Zinc Oxide
 - Copper Oxide
 - Graphite nanoparticles
- **Ability to produce nanoparticles as small as 2 nanometers**
 - Nanoparticles under 10nm are most effective and are currently difficult to produce

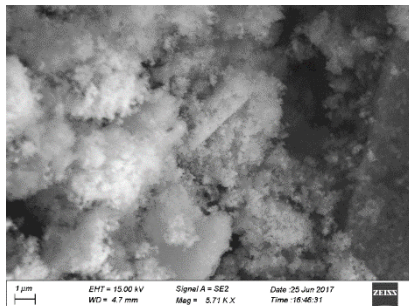
University of Louisville SEM and AFM images of our nanoparticles



- **Aluminum Oxide**, sized 2-80 nanometers
- **Usage:**
 - Add to paint, polish, glass and plastics to make up to 10-times more scratch resistant
 - Anti-microbial properties: can be added to medical equipment to make the environment bacterial free
 - Use for catalysis in basic organic chemistry synthesis including production of dimethyl ether, methanol, hydrocarbon liquid fuels

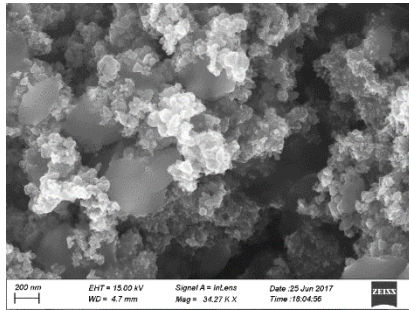


- **Iron Oxide**, sizes 5-10 (10 nm superparamagnetic) and up to 50 nm
- **Usage:**
 - Magnetic trains
 - Cancer treatment
 - MRI imaging
 - Chemical industrial catalyst
 - Rocket fuel additive
 - Magnetic quality enhancer

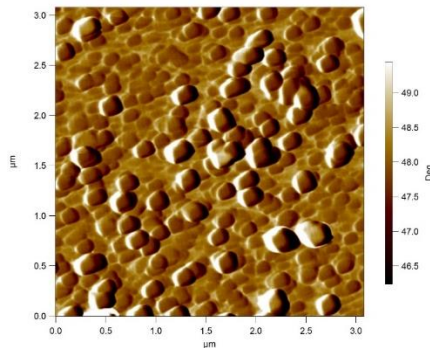


- **Copper Oxide**, sizes 10-30 nm
- **Usage:**
 - Enhance solar absorption of solar panels
 - High Temperature Superconductors (HTS)
 - Battery cathode
 - Chemical catalyst
 - Ceramic resistors, magnetic storage media, gas sensors, near-infrared filters, photoconductive and photo thermal applications
 - Rocket fuel catalyst

University of Louisville SEM and AFM images of our nanoparticles



- **Zinc Oxide**, sizes 10-30 nm
- **Usage:**
 - UV protection, which can be added to textiles or glass
 - Industrial chemical catalyst
 - Battery anode for improvement of lithium ion batteries performance



- **Graphite nanoparticles**, sizes 3-40 nm
- **Usage:**
 - Used as an anode and conductive additive in battery cathode
 - Composite materials
 - Conductive electrodes in solar
 - Added to fuel for 10% fuel saving
 - Added to grease to improve lubricating effects 5x

Patents: Two key patents

TOP-TIER IP LAW FIRM

DESCRIPTION



- Knobbe Martens is America's leading IP law firm

- Key breakthroughs are patented
- Freedom to operate
- Further patents are ready to be filed

Team



KIRILL GICHUNTS

Co-founder & CEO

- Invested into 15 startups
- Advised Microsoft
- University of California, Berkeley



JACK AGANYAN

Co-founder & President

- Financed \$600k of the project;
- Annual revenue \$90 million



ASH ARZUNYAN

R&D Engineer

- 30+ years prototype engineer
- Mechanical Engineering



Robert Avetisian

VP of Engineering

- VP of R&D
- Mechanical Engineering



Anahit Markaryan

Chemist

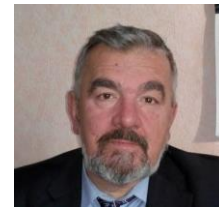
- MA Chemistry



SUREN MANUKYAN, PHD

Co-founder and Chief Scientist

- 45 years as senior scientist
- PhD Radio Physics/Electronics



EVGENIY POLUNKIN, PHD

Chemist and nanotechnology scientist

- 35+ years applied chemistry/nanoscience
- Studied under Alexander Nesmiyanov
- Ph.D. Chemistry



ARMEN KOCHIRIAN, PHD

Physicist and nanotechnology scientist

- 30+ years theoretical physics
- Worked with V. Ginsburg
- Ph.D Physics Institute



AVAG AVAGYAN, PHD

R&D Scientist

- 30+ years in scientific R&D
- PhD in Microelectronics

Interest from corporations and governments

- Corporations and organizations that H2 Energy Renaissance has been in talks with
- The companies are interested to purchase and/or license the NanoHydrogen Generator
- Combined Annual Revenue of potential clients: over \$1,000,000,000,000



- Countries interested that H2 Energy Renaissance has been in talks with
- Governments as potential clients: 11 countries with GDP of \$20,000,000,000,000



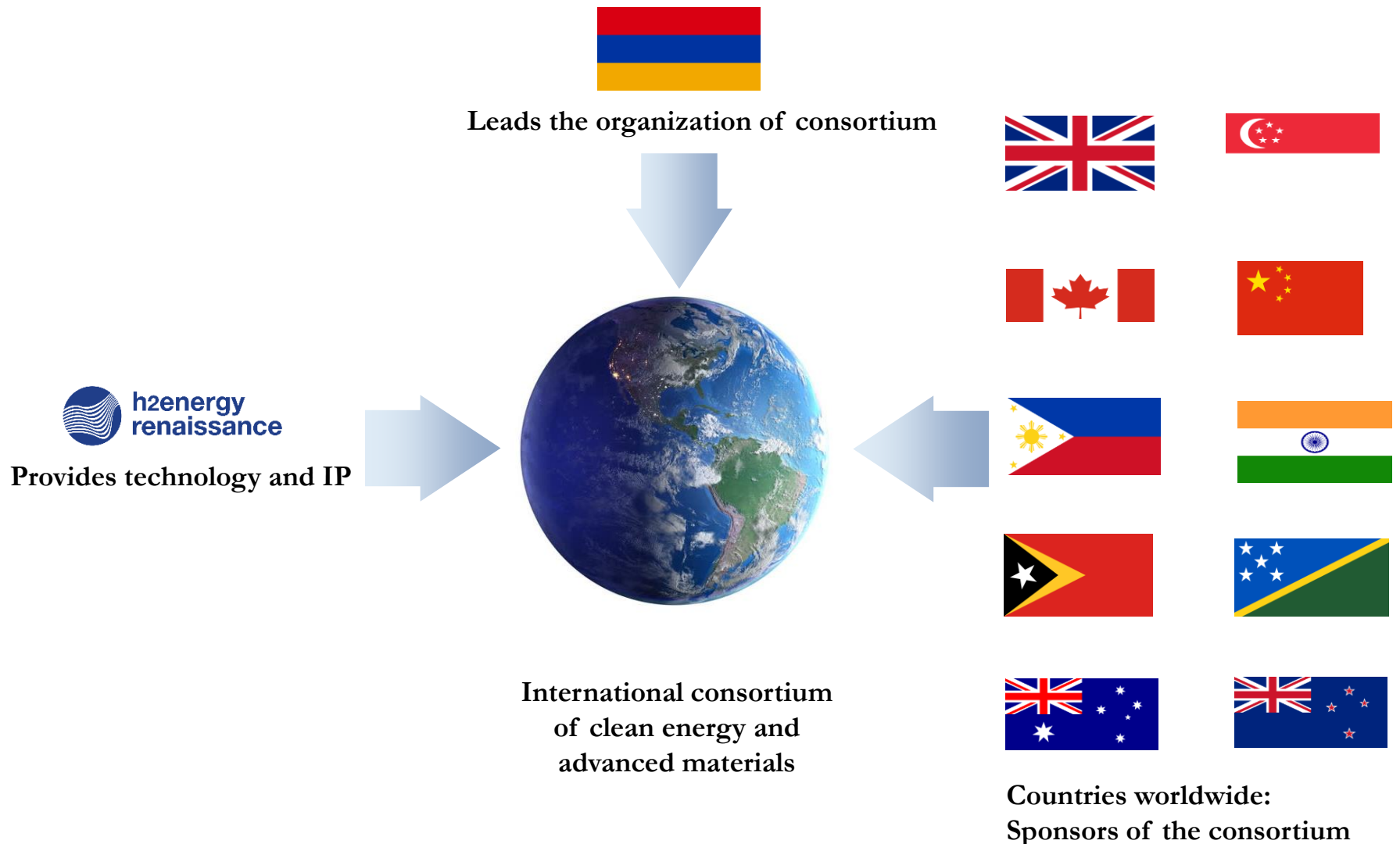
Market roll-out

- **Create demonstration facility**
- **\$5 - 10 million investment**
 - Allow to showcase and license the technology to companies world-wide
- **Build a manufacturing and production facility to produce 1200 unites per year**
- **\$35 million investment**
 - Sell hydrogen as commodity for electricity/heat/transport fuel production
 - Build research and application for multi-industry advanced materials manufacturing around nanoparticles
 - Sell nanoparticles up 80% cheaper to dominate the market

Revenue potential:

- **Potential to sell 10,000 to 20,000 units annually per country**
- **License model could result in over \$2 billion annual revenue in 5 years**
 - assumes 5+ licenses sold

Multi-Country Consortium



Research institution testing and technological achievements

University of Louisville
Cal State LA

- Extensive tests of the nano particles at USA Universities



- New type of chemical structural bond (unrecorded in chemistry)
- New type of nanoparticle for clean energy production
- New technique for production of nanoparticles up to 90% cheaper than current methods
- New patent is currently being filed to protect the above mentioned inventions

Nano-Analysis

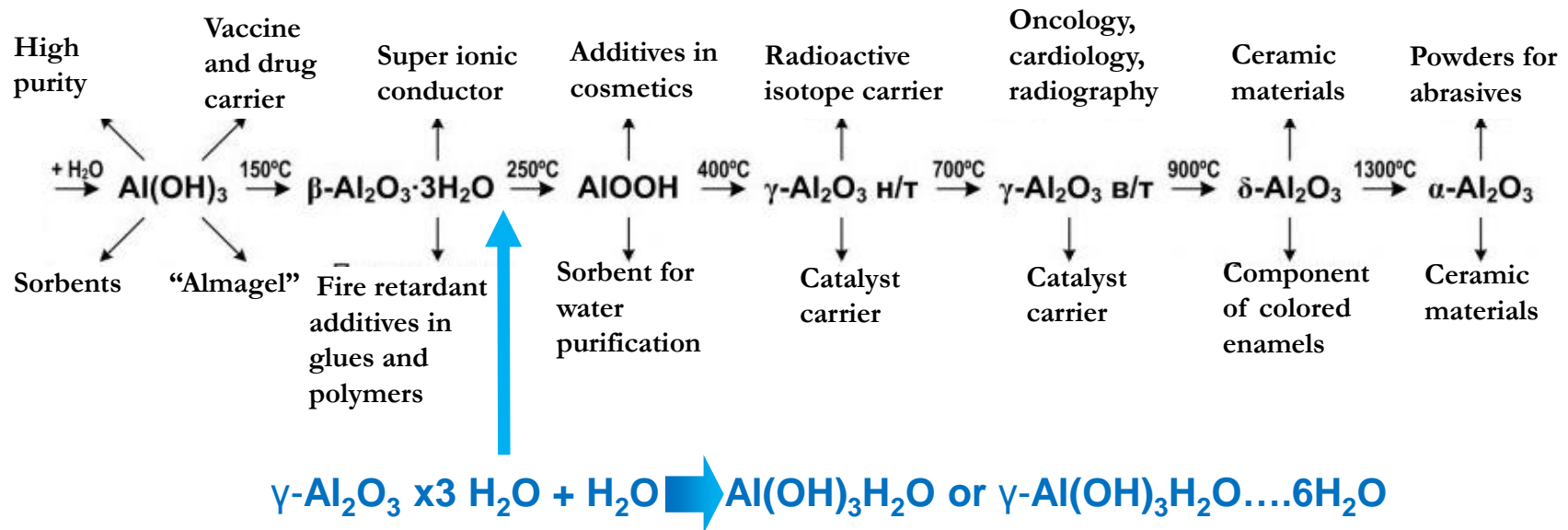


- New type of chemical structural bond (experimentally unrecorded in chemistry)
- New type of nanoparticle for clean energy production

Methods and Instruments:

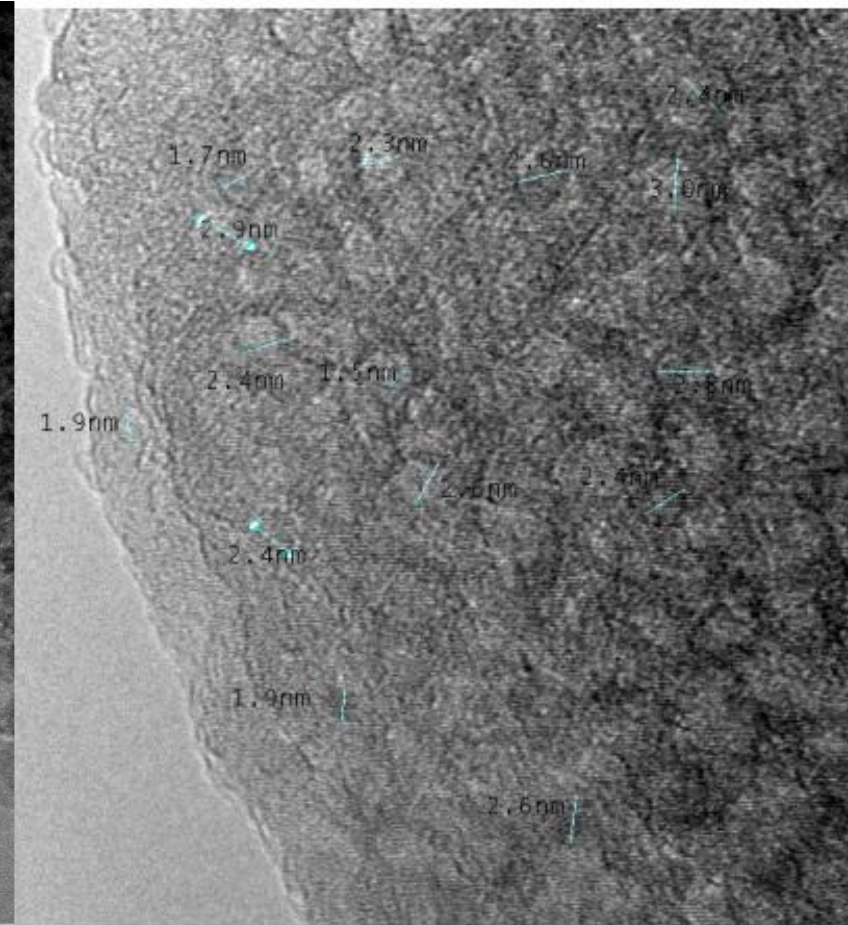
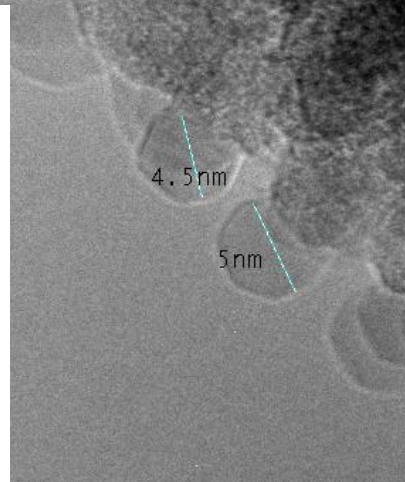
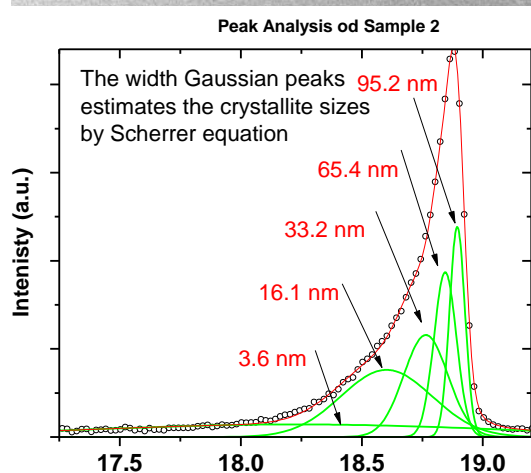
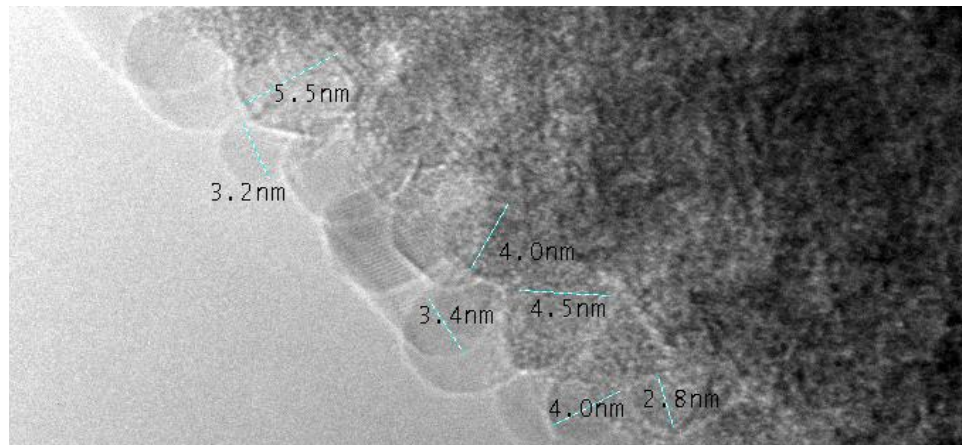
- Scanning Electron Microscope **SEM**
- X-ray Diffractometer **XRD**
- Atomic Force Microscope **AFM**
- Higher Resolution Transmission Electron Microscope **HRTEM**
- Thermogravimetric Analyzer **TGA**
- Differential Scanning Calorimeter **DSC**
- RAMAN Spectroscopy
- X-ray Photoemission Spectroscopy **XPS**
- Energy Dispersive Spectroscopy (**SDDs**)-EDS (**EDX**)
- Fourier Transform Infrared (**FTIR**)

All known forms of aluminum oxides and hydroxides and their transformation after heating

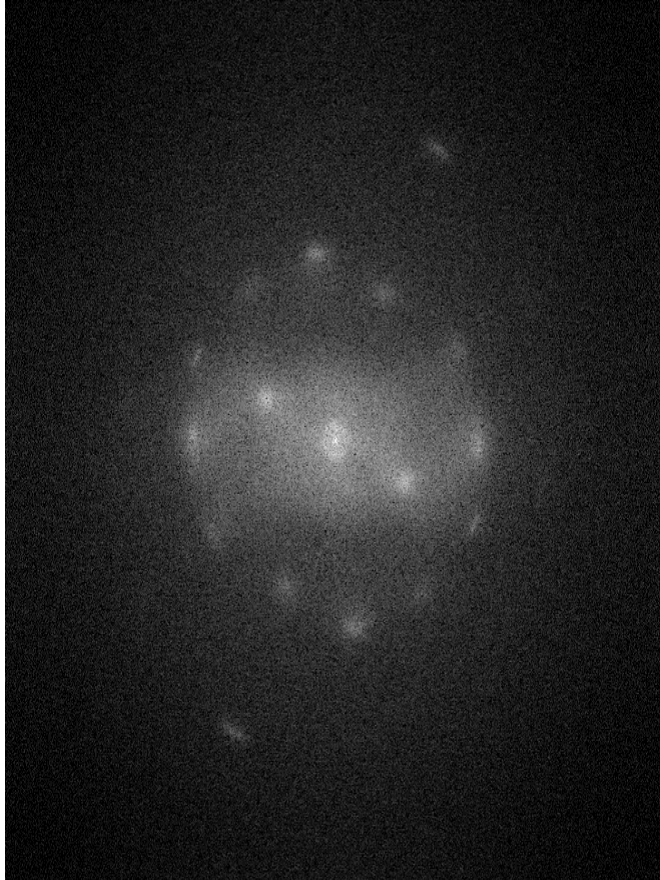


H2 Energy Renaissance synthesized and discovered a new form of aluminum oxide/hydroxide for production of clean energy

High Resolution Transmission Electron Microscopy and XRD Analysis reveals nanoparticles 2 nanometers in size

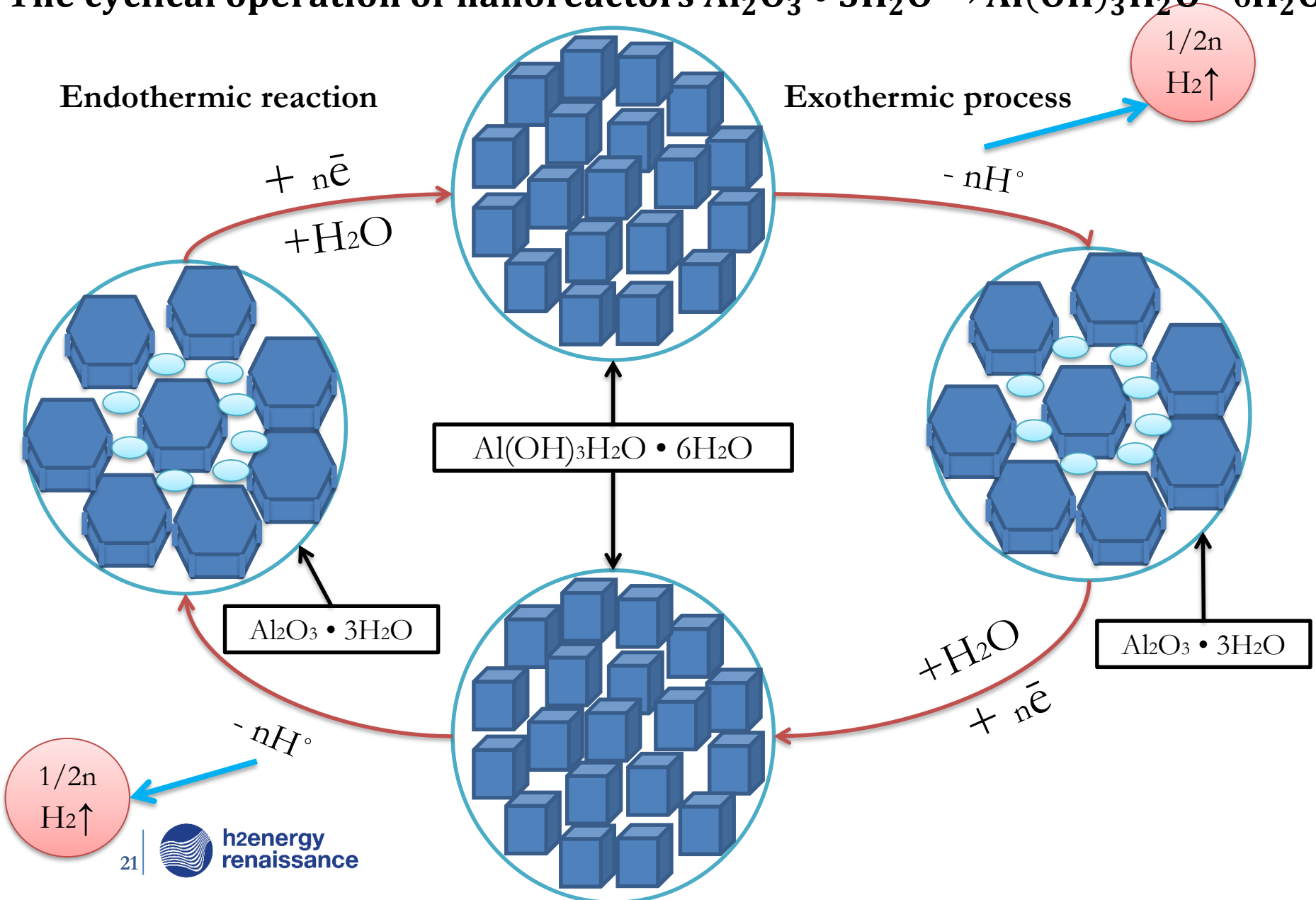


High Resolution Transmission Electron Microscopy of nano-cluster: nano-porosity and quantum points which allow electron transfer with minimal energy

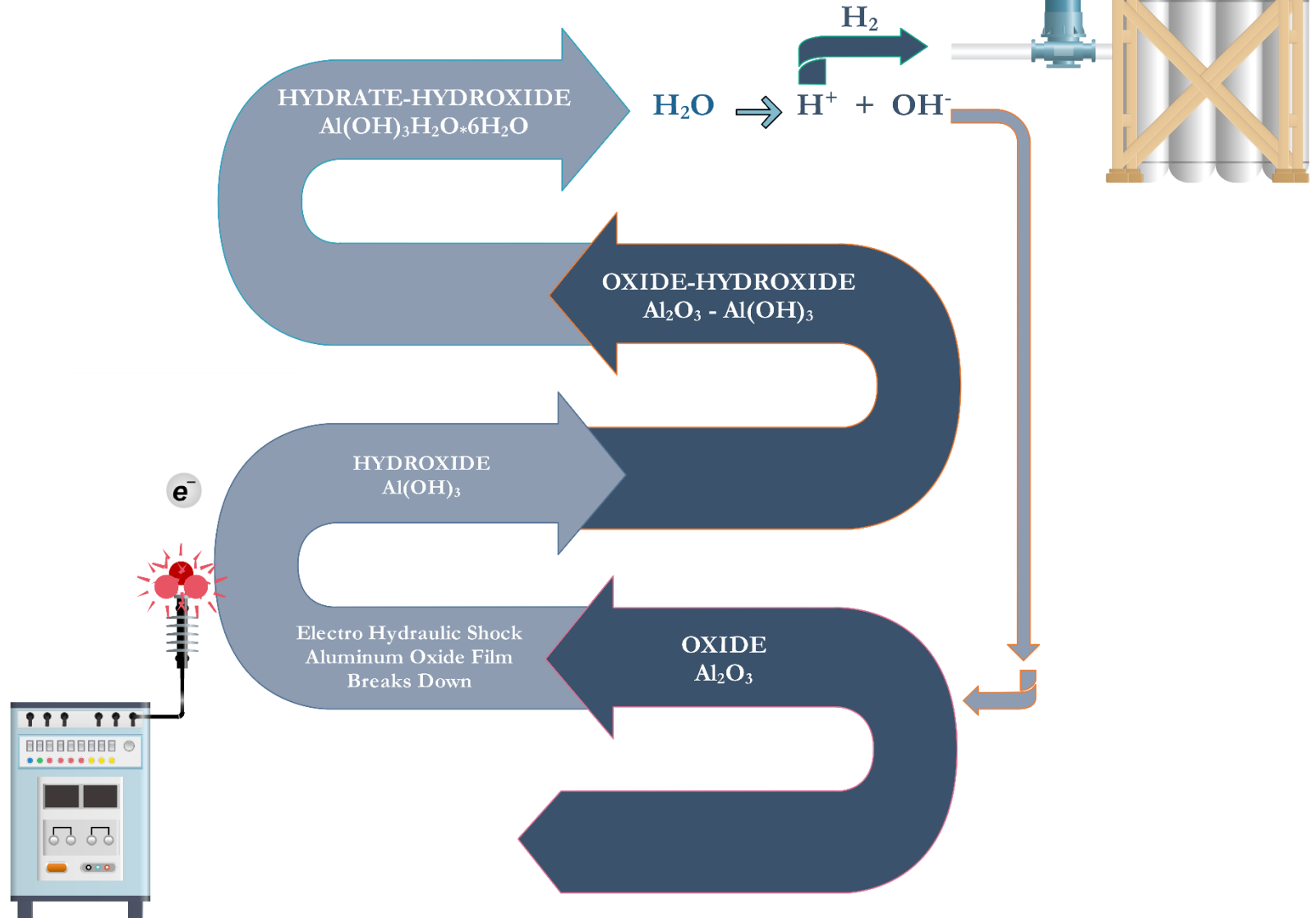


- Quantum points allow for efficient electron transfer
 - Applications in hydrogen production
 - Batteries
 - Potential application in semiconductors
- XPS spectroscopy of restricted zone revealed H2 Energy Renaissance nanocluster require much less energy than traditional oxides/hydroxides for electron transfer

The cyclical operation of nanoreactors $\text{Al}_2\text{O}_3 \cdot 3\text{H}_2\text{O} \xrightarrow{\bar{e}} \text{Al}(\text{OH})_3\text{H}_2\text{O} \cdot 6\text{H}_2\text{O}$



NanoHydrogen Generator System proton pump



Thank you for your attention!