
Clean Energy Opportunities at Los Alamos National Laboratory

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LANL is a National Security Laboratory

- **Ensuring the Safety, Security, and Reliability of the U.S. Nuclear Deterrent**
- **Reduce Global Threats**
 - Counter WMD
 - Nonproliferation and Surveillance
 - Strengthen infrastructure against attack
 - Support war fighter
- **Solve Other Emerging National Security Challenges**



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Energy Security is a National Security Mission

- Application of scientific disciplines, capabilities, and facilities at LANL stemming from our national nuclear security mission to energy security
- Energy Security mission focus on
 - Sustainable Nuclear Energy
 - Mitigating Impacts of Energy Demand Growth
 - Materials and Concepts for Clean Energy



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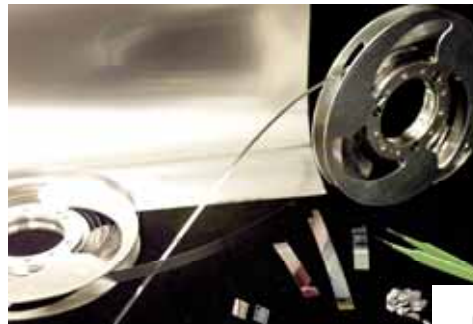


Aligned Crystalline Silicon (ACSi)

Novel materials technology for use in solar cells and flat panel displays:

- Film deposition process for high-performing, near-single-crystalline Si films
- Applications on low-cost, large size, non-single-crystalline substrates (metal tape, glass, etc.), including flexible surfaces

Seeking development partner



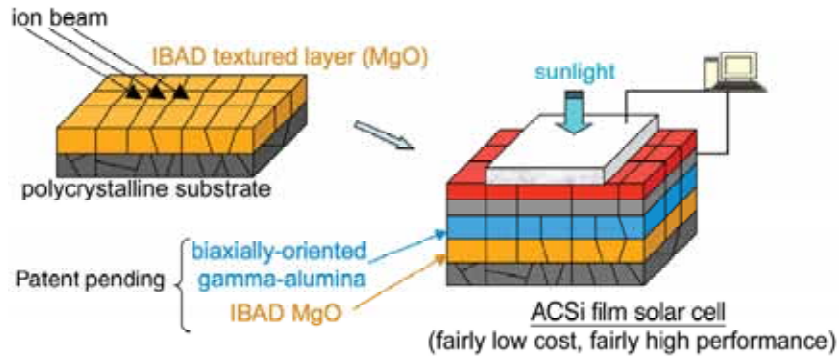
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The ACSi Technology

IBAD = Ion Beam Assisted Deposition



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ACSi Price Comparison

- Based on Capital Costs \$/Watt

– Single Crystal Si	Module \$3.48	Cell \$2.20
– Polycrystal Si	Module \$3.20	Cell \$2.02
– Thin-Film Amorphous Si	Module <\$3.20	Cell <\$2.02
– Exotic thin films	Module ~\$3-\$4	Cell ~\$1.25-\$3.85

– **ACSi Target:** **Module: \$2.00 Cell \$1.00**

Source: U.S. DOE Energy Information Administration average price per watt basis (2006)



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EnergyFit — Power Reduction Software



- Transparent software based on a novel, patented algorithm
- Lowers CPU power consumption directly using Dynamic Voltage and Frequency Scaling

License negotiations underway



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CPU Power Consumption Statistics



Year	Power (in megawatts)	# CPUs (in millions)
1992	160	87
1993	250	106
1994	392	128
1995	613	156
1996	959	189
1997	1,501	230
1998	2,349	279
1999	3,676	339
2000	5,752	412
2001	9,000	500
2002	14,083	607
2003	22,038	737
2004	34,485	896
2005	53,962	1,088
2006	84,439	1,321



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EnergyFit Applications and Benefits

Applications

- High Performance Computing (HPC) data centers
- Financial data centers / data center servers
- Internet service providers / search-engine farms
- Embedded processing systems (e.g., cell phone, network routers in the Internet, video-gaming consoles).

Benefits

- Reduces power consumption of processors by as much as 70% with minimal impact on performance
- Enhances reliability due to reduced temperatures
- Shrinks data center footprint
- Lowers capital and recurring expenses



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Treatment for Produced Water

- Remove hydrocarbon contaminants from saline water produced during crude oil pumping
 - Untreated produced water must be handled as a hazardous waste
- Treated water can be returned to reservoir, disposed of as non-hazardous waste, or desalinated for use in power plant cooling, irrigation or consumption
- Field tested and proved
- Significant cost savings

Seeking
commercialization partner

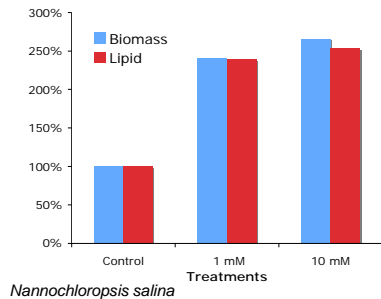


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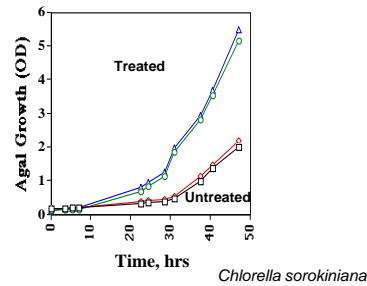


Algae Production of Lipid



Working with to optimize formulation for algae

- Plant growth stimulant that speeds growth algae and produces greater biomass and lipid output
- Lipid produced can be used as feedstock for chemical production and bio-diesel

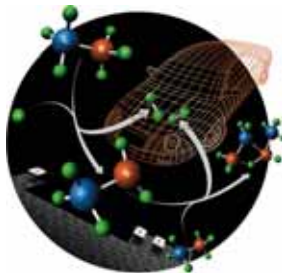


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Hydrogen as a “clean” transportation fuel



Chemical Hydrogen Storage Center of Excellence is a leading facility to solve problems for the transition to a hydrogen-fueled economy.

- Developing use of ammonia borane for hydrogen storage and fuel regeneration
 - Goal: vehicles with an adequate driving range.



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Renewable Energy Capture and Storage



• Center for Integrated Nanotechnologies possesses *world-class fabrication, modeling & simulation, and measurement* capabilities to design and build the structures needed for nano-supercapacitor materials.

- Developing supercapacitors to capture and store energy generated by solar and wind
 - Goal: Put energy into the grid when and where needed



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