Lyzerdyne Advanced Energy Lab

Laboratory Capability Statement

LYZERDYNE is a privately operated independent research laboratory focused on experimental energy systems, advanced electrochemical processes, synthetic crystal growth, applied RF systems, and instrumentation development. The laboratory integrates custom-built hardware, precision measurement systems, parametric modeling, and rapid prototyping capabilities to support exploratory research in emerging energy technologies and material sciences.

Core areas of investigation include deuterium enrichment systems, electrolysis optimization, synthetic crystal engineering, RF-assisted experimental platforms, spectroscopy, and hydrogen-loaded materials reactor concepts. Laboratory infrastructure emphasizes hands-on system development, controlled experimentation, in-house fabrication, and locally maintained data and simulation resources.

All major systems are designed, assembled, modified, or operated in-house with an emphasis on technical rigor, experimental flexibility, iterative engineering, and independent research capability.

Core Research Areas

- Deuterium Isotope Enrichment (D_2O Production)
- Electrolysis Optimization and Automation
- Flame Fusion Crystal Growth (Verneuil Process)
- Synthetic Ruby & Sapphire Engineering
- RF, Microwave & Resonance Experimentation
- Spectral and Optical Analysis
- Hydrogen-Loaded Materials Research
- Parametric Modeling & Simulation of Reactor Systems
- Instrumentation Development and Data Acquisition

Complete Facilities & Equipment List

Electrolysis & D_2O Enrichment

- Two 10-cell cascading electrolysis units with automated transfer
- One single-cell electrolysis unit with Arduino-based real-time logging
- Two dedicated electrolysis reactor test beds

Crystal Growth Systems

- Custom-built Verneuil torch system for synthetic ruby/sapphire production
- Diamond saw for slicing gemstone rough
- Graves MK-1 faceting and crystal geometry preparation system for optical material experimentation

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Distillation & Wet Chemistry

- Short path distillation system (24/40 joints)
- Soxhlet extractor with Allihn condenser
- Vigreux fractionation columns (7”–300 mm)
- Cow receivers and thermometer adapters
- Round-bottom and Erlenmeyer flasks (125 mL–1000 mL)
- Cold trap and vacuum filtration system
- Pipettes and powder funnels
- Heated mantle with magnetic stir bars
- Max Water 6-stage RODI filtration system with deionization filter (100 GPD)

Measurement & Calibration

- LACHOI 200 g × 0.001 g analytical balance
- Class A graduated cylinders (5 mL–100 mL)

- 100 mL glass burette
- ATC Brix/SG refractometer
- Borosilicate pycnometers and SG bottles
- Dual-channel thermocouple logger (Arduino + Excel)
- Assorted K-type thermocouples for integrated temperature monitoring
- KAIWEETS HT208D clamp meter (True RMS, VFD-safe)
- KAIWEETS TRMS digital multimeter
- Digital pressure sensors for electrolyte and vapor monitoring
- Full electronics toolkit (soldering, repair, prototyping)

Radiation & Neutron Detection

- GQ GMC-600 Plus Geiger Counter (Alpha, Beta, Gamma, X-ray)
- NEUTRON-LITE ^{3}He proportional counter with MCA-LITE

RF, Spectrum & Shielded Testing

- RAMSEY ELECTRONICS STE4400 shielded test enclosure for RF-isolated experimentation and signal containment
- NanoVNA-F V2 vector network analyzer for impedance characterization, resonance studies, and RF circuit evaluation
- RTL-SDR Blog V4 software-defined radio platform for wideband RF monitoring and signal analysis
- GQ EMF-390 EMF/ELF/RF meter with integrated 2.5 GHz spectrum analyzer
- HP Agilent Keysight 5342A microwave frequency counter (Options 001, 011, H12)

Machining & Fabrication

- Haas SL-10BB CNC lathe
- TRAK DPM3 CNC mill with SMX controller
- Nardini MSC 1440E manual lathe with DRO
- Kalamazoo manual mill with DRO
- Harig 612 surface grinder
- Clausing drill press
- Horizontal stock cutoff saw
- 20-ton shop press

- Benchmaster 4-ton press
- Butler 10/60 injection molding machine
- Quick-change MUD frame system for rapid mold swaps
- Famco 18 kick press
- Greenerd 3-12-PW press
- 6” bench grinder
- Dual pedestal polishing buffer
- 12” disc sander
- 18 lb vibratory polishing bowl
- Pressure casting tank (30 gallon)
- 90A MIG welder
- Bambu Lab A1 3D printer with AMS Lite (4-spool)
- VEVOR manual combination rolling mill (4.4”)

Casting & High Temperature Processing

- 3 CFM vacuum investment casting machine (9” × 8” bell jar)
- TOAUTO TRF3000 1800W digital smelting furnace
- VEVOR 1500W melting kiln (2192°F)

Power & Electrical Systems

- 2000W variable AC transformer (Variac) with custom-built 450V DC full-wave voltage doubler
- 30V 10A bench power supply for instrumentation and electrolysis systems
- Siglent SDS1202X-E 200 MHz digital storage oscilloscope
- Koolertron DDS 60 MHz dual-channel arbitrary waveform generator (275 MSa/s)

Separation & Sample Preparation

- Drucker 511B laboratory centrifuge
- 10 L ultrasonic cleaner

Metrology & Inspection

- Nikon V-12 profile projector
- Inspection station with gage pins, micrometers, calipers, and height gage
- USB digital microscope imaging station with Raspberry Pi capture workstation
- Dedicated digital camera for photographic documentation

Optical & Spectral Analysis

- Arduino-based visible light spectrometer (custom-built)
- Raspberry Pi spectroscopy workstation running PySpectrometer2
- USB microscope imaging systems for gemstone and material surface analysis

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Environmental & Safety Systems

- Multiple ABC fire extinguishers
- Fire blanket
- WEN shop air filtration system
- Continuous laboratory monitoring and recording infrastructure
- Nitrile gloves
- Dual-cartridge respirator
- Heat-resistant gloves
- Laser safety goggles
- Flame-retardant laboratory coat/smock

Data Infrastructure & Simulation

- Dedicated Raspberry Pi laboratory server with MediaWiki and Gitea
- 10-node Raspberry Pi 4 cluster with SLURM for parametric simulations
- PC workstation for modeling, instrumentation, and data analysis
- Secure air-gapped private server capability
- All laboratory data and source code stored locally on private infrastructure

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Materials & Reagents

- Laboratory-grade D_2O sample for comparative testing
- NaOH and KOH electrolytes

- High-purity alumina oxide and chromium dopants for ruby growth
- Gas regulators and laboratory-grade hydrogen and oxygen cylinders

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Planned Acquisition

- Bruker Alpha II FTIR Spectrometer (~$25,000) for advanced deuterium bond characterization and materials analysis

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Contact & Website

Website: https://lyzerdyne.com
Founder / Researcher: Andy Mullé
Location: Private Research Facility

Note

Lyzerdyne is a self-funded independent laboratory focused on exploratory engineering, experimental energy systems, materials research, and instrumentation development. The laboratory operates with an emphasis on responsible experimentation, technical precision, and practical in-house system design.
