

ENABLE: Energetic Neutral Atom Beam Lithography/Epitaxy

Features

Employing an energetic collimated beam of neutral nitrogen or oxygen atoms, ENABLE comprises a dual-function nanofabrication technology capable of both growing thin films and etching high-aspect-ratio nanostructures. It is unique in that its low-temperature operation spares the activation of diffusive and other unwanted surface chemical changes that are drawbacks of existing nanofabrication processes. Because its precise high-aspect-ratio nanoscale etching and rapid high-quality thin film growth capabilities can be readily combined, ENABLE technology is theoretically capable of fabricating details approaching 1 nm in size, giving it greater versatility than current nanofabrication processes.

Applications

- Wide bandgap semiconductors
- Solid-state lighting
- Ultraviolet and blue light-emitting diodes (LEDs) and lasers
- Multicolor flat-panel display technologies
- Room-temperature spintronic-based devices
- Photovoltaic devices
- Photonic crystal devices
- High-quality dielectrics (super capacitors)
- High-capacity microbatteries
- NEMS and MEMS structures
- Micro- and nanofluidics
- Nanowires

Benefits

- **Low-Temperature Processing:** Avoids ancillary damage to and alteration of delicate nanoscale components commonly caused by current nanofabrication techniques.
- **Rapid High-Quality Thin Film Growth:** Delivers a very high flux of energetic atoms, yielding commercially feasible film growth rates exceeding 10 nm/min for nitride and oxide materials.
- **Precise High-Aspect-Ratio Nanoscale Etching:** Polymer etching rates of 100 nm/min or more with aspect ratios exceeding 35:1 and critical feature sizes much less than 100 nm.
- **Versatility:** Etching and thin film growth can be readily combined and the technology is theoretically capable of fabricating details down to 1 nm or less in size.

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This image is a scanning electron micrograph of tall (35:1 aspect ratio), closely packed, well-defined, 200-nm-diameter pillars etched with ENABLE into a polyimide film using nanospheres as a shadow mask.

Los Alamos 2006 Winners

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Green Primaries: Enviro-Friendly Energetic Materials

MICHELLE: A Software Tool for Three-Dimensional Modeling of Charged-Particle-Beam Devices

PixelVizion: An NPU-Embedded Visualization Accelerator for Large Data Sets

Trident