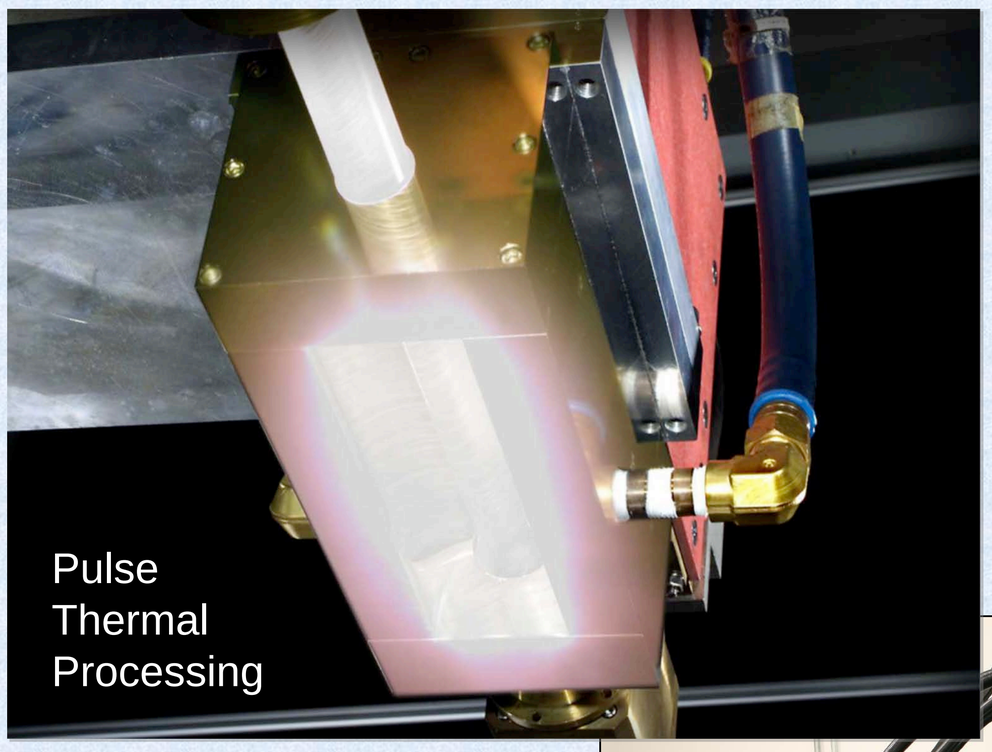
Pulse Thermal Processing (PTP) - Enabling Technology for Cost Effective Manufacturing of High Performance Flexible Microelectronic Devices

Oak Ridge National Laboratory - Materials Processing Group

An enabling transient process to be able to thermally process thin-film and nanoparticle material systems on temperature sensitive polymer substrates

Capabilities

- Energy flux > 20 kW/cm^2
- Heating rates ≈ 600,000°C/s
- Exposure time on (ms) and (μs) scales
  - Control diffusion on (nm) scale
  - Minimal thermal effects on substrate, allowing processing on polymers
- Broad area processing
  - Greater than 1,000 cm^2
- Roll-to-roll processing compatible



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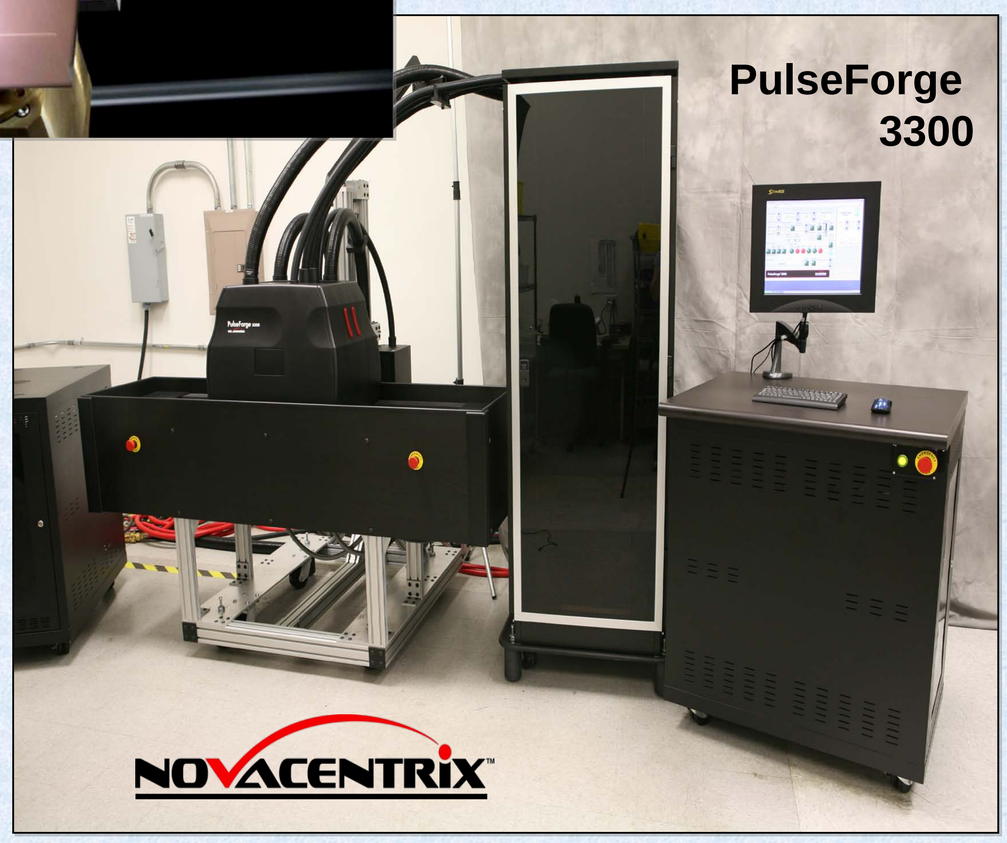
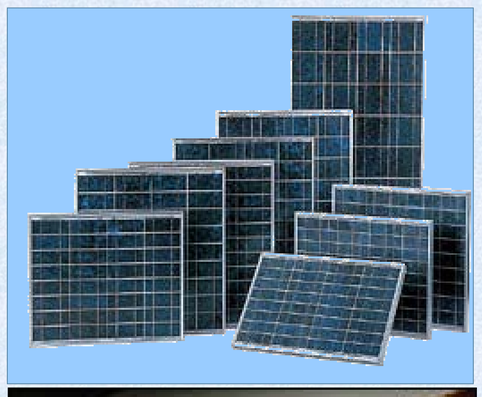
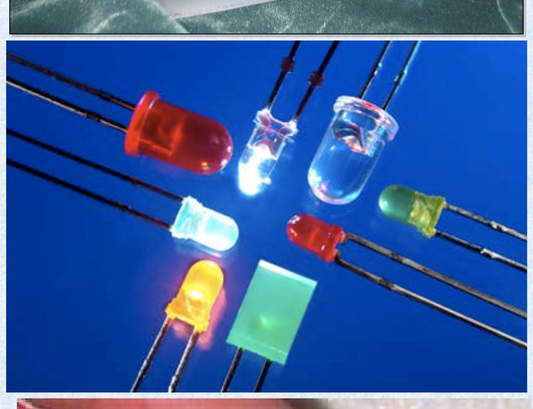
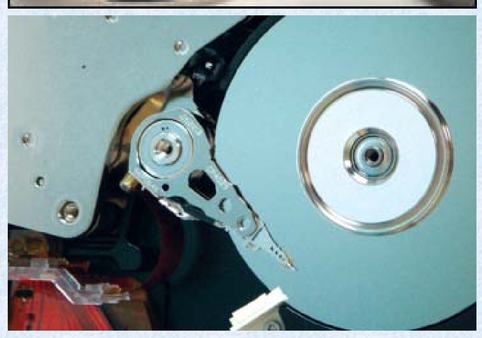


Applications

- Photovoltaics
  - Improve collection efficiencies by reducing defects, introducing nanocrystalline/amorphous composite structure, or sintering nanoparticles on polymer substrates
- Thin film transistors (TFT) for flat panel displays
  - Improve electron mobility by introducing nanocrystalline phase in amorphous silicon on polymer substrates enabling light-weight flexible flat panel displays
- Thin film batteries
  - Improve power density by forming nanocrystalline cathodes on polymer substrates
- Light emitting diodes (LED)
  - Improve efficiencies through annealing defects of quantum dot material systems to perform at levels exceeding today's best
- Magnetic media
  - Increasing storage density utilizing chemically structured nanoparticles
- Flexible Electronics
  - Sinter printable conductive inks on paper and plastic substrates







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