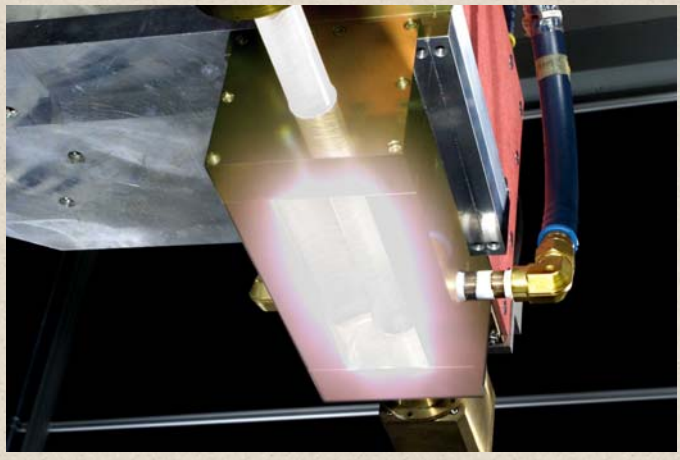
Pulse Thermal Processing (PTP) - Enabling Technology for Cost Effective Manufacturing of High Performance Flexible Microelectronic Devices

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

High Density Plasma Arc Lamp

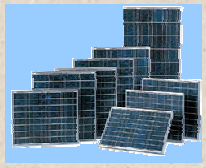


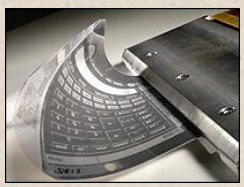
- Most powerful radiant arc lamp in the world
- Power densities up to 20 kW/cm^2
- Broad area processing with high radiant energies
  - Greater than 1,000 cm^2
- Roll-to-roll processing compatible
- Processing times, 1 ms to continuous output
- Heating rates approaching 600,000°C/s
  - Rapid heating rates allow *controlled diffusion on nanometer scale*
  - Minimal thermal effects to substrate allowing processing on polymer substrates

Pulse Thermal Processing (PTP) Applications

- Photovoltaics
  - Improve collection efficiencies by reducing defects, introducing nanocrystalline/amorphous composite structure, or sintering nanoparticles on polymer substrates
  - Reduce cost by large area processing
- 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

Photovoltaics





Flat Panel Displays

Thin Film Battery

Solid State Lighting

Magnetic Media

Point of contact: Chad Duty
(865) 574-5059
dutyc@ornl.gov

OAK RIDGE NATIONAL LABORATORY

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