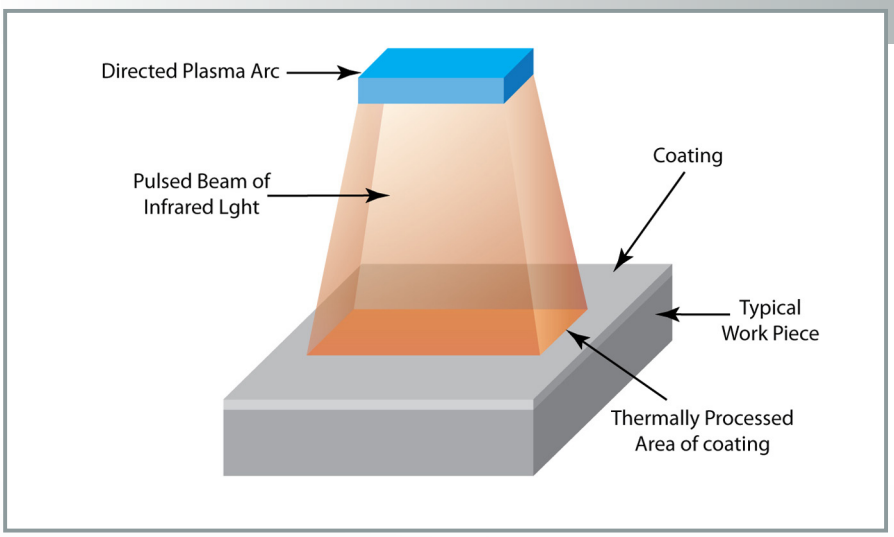
Pulse Thermal Processing of Functional Materials Using a Directed Plasma Arc

UT-B ID 200301290



Technology Summary

Using pulses of high density infrared light from a directed plasma arc, ORNL researchers invented a method to thermally process thin films and other functional materials on temperature-sensitive substrates. This approach, pulse thermal processing, could revolutionize the handling of functional materials because it reduces the necessary processing time to seconds from what is currently minutes or hours.

With this invention, thin films can be processed on sensitive polymer substrates at high temperatures with little to no harmful effect on the material. This is an improvement over conventional means, which cannot tolerate high temperatures.

In the basic method, the researchers expose areas of a functional material to at least one pulse of infrared radiation from a plasma arc lamp. The lamp emits broadband infrared radiation for no more than 10 seconds. Samples that can be processed this way include nanoparticles, thin or thick film, and photovoltaic material. The temperature sensitive substrate supporting the sample can be a biomaterial, polymer, resin, metal, ceramic, or semiconductor.

Advantages

- Permits the use of light weight, flexible substrates
- Reduces processing time substantially

Potential Applications

- Crystallization
- Annealing of thin films
- Processing thin film transistors or batteries
- Processing photovoltaic or thermoelectric devices on polymers
- Protective layers for electronic chips
- Surface treatment of polymer implants
- Phase transformations
- Processes that would benefit from sequential rapid heating in millisecond durations

Patent

Ronald D. Ott, Craig A. Blue, Nancy J. Dudney, and David C. Harper, *Pulse Thermal Processing of Functional Materials Using Directed Plasma Arc*, U.S. Patent 7,220,936, issued May 22, 2007.

Lead Inventor

Ronald D. Ott
Materials Science and Technology Division
Oak Ridge National Laboratory

Licensing Contact

Alexander G. DeTrana
Technology Commercialization Manager, Materials Science
UT-Battelle, LLC
Oak Ridge National Laboratory
Office Phone: 865.576.9682
E-mail: detranaag@ornl.gov

PARTNERSHIPS