Air Force SBIR/STTR

Air Force SBIR/STTR Transition Story

Transition

An example of Air Force supported SBIR/STTR technology that has been transitioned into an Air Force or other DoD system or subsystem or used by Air Force test ranges and facilities or maintenance depots.

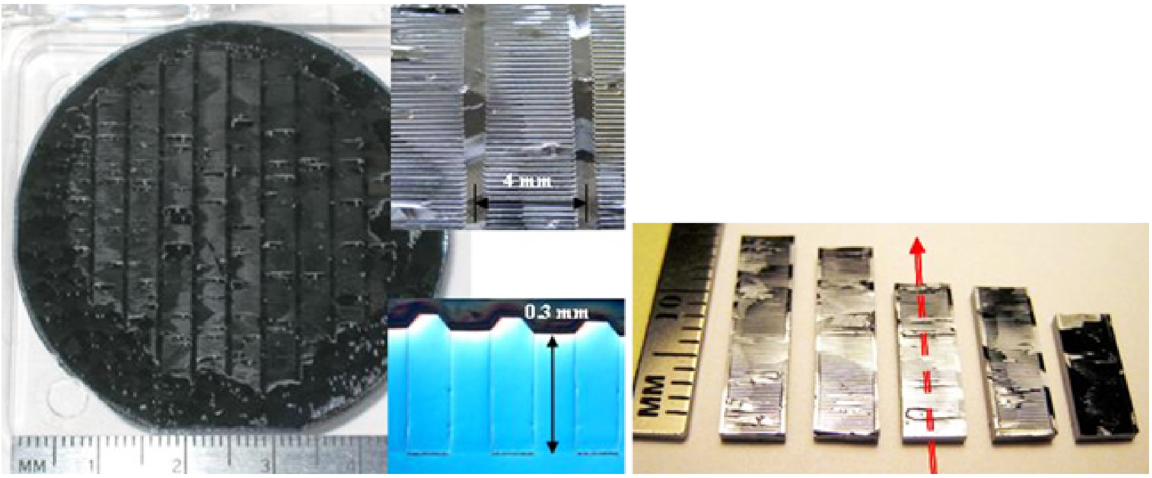
STTR Topic Number:
AF06-T010

Title:
Periodically Oriented Nonlinear Optical Materials

Contract Number:
FA9550-08-C-0026

Company Name:
Physical Sciences Inc., Andover, MA

Technical Project Office:
Air Force Office of Scientific Research, Arlington, VA



Left: OP-GaAs crystal fabricated on full wafer. Insets are close-up of OP grating surface and Nomarski image of cross section. Right: Diced OP-GaAs for laser wavelength conversion. Laser beam (arrow) passes below the surface.

Commercial Methods for Production of Orientation-Patterned Gallium Arsenide (OP-GaAs)

- Improved tunable laser sources in the midinfrared wavelength band are needed for laser-based infrared countermeasures
- Physical Sciences Inc. (PSI) demonstrated the feasibility for a fabrication method of OP-GaAs which exclusively utilizes processes available from commercial vendors
- Aircraft defense against heat-seeking missiles will be considerably strengthened with high-power lasers converted into the midinfrared band
- PSI is employing the technology for fabrication of OP-GaAs crystals to provide early prototype commercial production for a major U.S. aerospace prime contractor

Commercialization Pilot Program Series

091009-001

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Air Force Requirement

Improved tunable laser sources in the midinfrared wavelength band are needed for laser-based infrared (IR) countermeasures. Existing lasers do not meet this need but with nonlinear optical (NLO) crystals, these lasers can be made to tune the range of interest. Compound semiconductor crystals with engineered non-linear optical properties are the best materials for many practical applications. In particular, orientation-patterned gallium arsenide (OP-GaAs) has the potential for widespread use in the Air Force, but there is no commercial source for the material.

STTR Technology

Physical Sciences Inc. (PSI) demonstrated the feasibility for a fabrication method of OP-GaAs which exclusively utilizes processes available from commercial vendors. Methods from the semiconductor industry are utilized, including molecular beam epitaxy, wafer bonding, etching, photolithography, and vapor-phase epitaxy.

Successful process integration makes fabrication more practical and increases the NLO device design space. Batch fabrication of templates by a sequence of vendors will make their production routine, available from multiple sources, and more affordable. Establishing an independent, commercial OP-GaAs crystal product will assure that production volumes can be developed in future years. Modifications are now underway to adapt the process into one for fabrication of orientation-patterned zinc selenide (OP-ZnSe) crystals.

Transition Impact

Aircraft defense against heat-seeking missiles will be considerably strengthened with high-power lasers converted into the midinfrared band. Coherent, powerful, and tunable laser beams based on the NLO properties of OP-GaAs and OP-ZnSe crystals will enable these laser systems.

PSI is presently employing the technology for fabrication of OP-GaAs crystals to provide early prototype commercial production for a major U.S. aerospace prime contractor. Closely related crystal products, such as OP-ZnSe, are in development and will expand the areas of application

Company Impact

This program expands upon PSI's capability to supply critically important optical components for NLO devices.

PSI develops and commercializes advanced technologies for the aerospace, energy, environmental, manufacturing and medical markets. Core capabilities include physical chemistry, materials science, fluid physics, optics, electronics and computer science. Significant expertise has evolved in the interdisciplinary fields of semiconductor photonics, electro-optics, electrochemistry, thermochemistry, composite materials, and electromechanics.

U.S. AIR FORCE

SBIR/STTR

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