



NASA Langley's Ferroelectric Light Control Device

Innovative use of ferroelectric materials for solid state control of light beam

NASA Langley researchers have developed and patented a novel use of a smart optical material for controlling the phase of coherent light. The ferroelectric light control device provides a simple means to control the propagation of light, as might be used for intensity and phase control of laser communications systems, for example. Typical methods employed today for laser phase control include conventional optical components such as lenses, mirrors, or gratings, coupled with a mechanical controller, either an electric motor or actuator, or in some cases a MEMS device. The NASA technology is paradigm shifting in that the need for external control is eliminated. The ferroelectric light control device operates purely in the solid state, using the optical changes in the ferroelectric material as a function of applied electric field in multiple orientations to change the optical transmission properties of the device. The electrodes used to construct the multi-direction ferroelectric light control device are key to its performance.

Benefits

- No need for external mechanical control due to device operation's dependence upon the solid state electro-optic properties of the ferroelectric material used
- Extreme environmental tolerance, including resistance to the effects of vibration or acceleration
- Very rapid adjustments possible
- Highly reproducible control, no adjustments, or calibration required
- Patented technology for multi-directional control

partnership opportunity



Applications

The technology offers wide-ranging market applications, including:

- Laser communication systems, particularly for moving systems under environmental and mechanical duress
 - Aircraft to ground communication
 - Defense applications
- Biomedical applications where extreme control and reproducibility are needed
- Applications where instantaneous light control with phase or intensity is required

The Technology

The NASA ferroelectric light control device technology leverages the unique electro-optical properties of known ferroelectric compounds, like barium titanate or lithium niobate, to create a solid state device for controlling the phase and intensity of a laser light beam. The ferroelectric material undergoes spontaneous polarization via induced dipoles in the crystal domains. The key to the NASA device technology is the design of the multiple electrode patterns to control the orientation of applied electric field, along with a combination of multiple device layers, controlled thicknesses, or optical coatings. Specific designs are easily developed and manufactured depending on the end-use application requirements.

U.S. Patent 7,379,231

For More Information

If your company is interested in licensing or joint development opportunities associated with this technology, or if you would like additional information on partnering with NASA, please contact:

The Technology Gateway

National Aeronautics and Space Administration

Langley Research Center

Mail Stop 218

Hampton, VA 23681

757.864.1178

LARC-DL-technologygateway@nasa.gov

technologygateway.nasa.gov

www.nasa.gov



LAR-16950-1