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Hydrothermal Growth of Lithium Borate Crystals with High Optical Quality (01-034)

Simple, Economic Production of Hard Crystal Materials Enabled by a Wide Bandgap

Market Overview

This hydrothermal growth of tetragonal lithium borate crystals produces high optical quality crystals suitable for a wide variety of optical devices. In the current market, optical devices produce a constant demand for high quality single crystals. This market demand has fostered the acceptance of lithium borate crystals. Traditionally, lithium borate crystals are prepared via demanding high pressure methods that only produces small crystals. Clemson University researchers have developed a hydrothermal growth technique that produces lithium borate crystals sufficiently large for optical applications. The approach is economical, easily scalable for production, and results in high optical quality crystals due to the introduction of a wide bandgap.

Application

Optics devices; Solid-state laser applications

Stage of Development

Proof of Concept

Advantages

- Advantageously wide bandgap, allowing the creation of crystal hosts appropriate for ultraviolet laser applications
- Creates uniaxial crystal properties, allowing for the crystal to phase match and act as a birefringent
- Acentric crystal design, increasing the crystals' application in non-linear optical laser applications

Technical Summary

This hydrothermal growth approach produces tetragonal lithium borate single crystals suitable for various laser applications. The tetragonal lithium borate crystals contain acentric and uniaxial properties, and exhibit a broad energy range in which no electron states can exist. These properties are present due to the large bandgap; this is specifically important for optical non-linear solid state laser applications requiring second, third, or forth harmonic generation. Ultimately, Clemson University researchers developed an economically sound, hydrothermal synthesis method of producing acentric, tetragonal lithium borate crystals that contain considerable potential for near UV, UV and deep UV optical applications.

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About the Inventor

Dr. Joseph Kolis is a Professor of Inorganic Chemistry at Clemson University, He earned his Ph.D. at Northwest University working in organometallic chemistry and conducted postdoctoral research at McMaster University. Dr. Kolis is a founding member of the Center for Optical Materials Science and Engineering Technologies (COMSET) at Clemson University where his group studies the synthesis and chemistry of novel inorganic compounds that demonstrate unusual structures and properties. He is the recipient of numerous awards, including the National Science Foundation Award for Special Creativity and the Alfred P. Sloan Fellowship and holds over seven patents.

For More Information

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Utility	United States	10/888,049	7,374,616	01-034	Joseph Kolis