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# Hydrothermal Crystal Growth that Eliminates Spontaneous Emission (2011-108)

*Eliminates Amplified Spontaneous Emission during Crystal Growth*

## Market Overview

This hydrothermal approach to growing single crystal oxide hosts resolves the issues posed by amplified spontaneous emission (ASE). ASE is the result of unwanted internal reflection of photons at the lasing frequency within the laser crystal. The consequences of ASE include induced emission of ions from the excited state and unwanted internal lasing in random directions. These effects take away the needed amount of power from the laser and severely inhibit the performance of the lasers. From an economic standpoint, the global market for solid state lasers is projected to steadily increase, reaching $850 million by 2020. This steady growth is primarily due to the demand for lasers with operational thresholds that can be reached at relatively low intensities of laser pumping. Clemson University researchers have developed a hydrothermal crystal growth process that minimizes ASE and its negative effects by growing layers of doped host crystals that contain absorbing ions. The approach results in improving the quality of high power lasers and overall laser performance by minimizing or eliminating ASE.

## Application

Optics; High power lasers

## Stage of Development

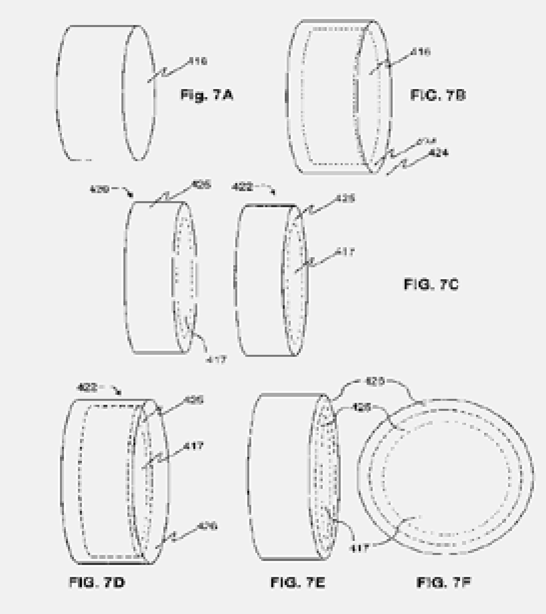
Validated Prototype

## Advantages

- Improves power and beam quality by eliminating ASE, enabling the creation of new products with improved lasing properties
- Introduces layers of doped host crystal around the edges of the lasing crystal as protection, preventing reflection of the spontaneous photons but not interfering with the coherent and directional lasing photons created by the stimulated emission

## Technical Summary

This approach to hydrothermal growth of single crystal oxide hosts reduces ASE and its resulting negative effects. Typically, a solid-state laser cavity contains a host material that is doped with a small amount of an activator ion. This specific approach creates single crystal oxide hosts doped with lasing ions containing layers of doped ions that suppress ASE.  Clemson University researchers employed a method to grow layers of doped host crystal on the edges and faces of the laser crystal that contain absorbing ions that help eliminate the internally reflected photons. This ultimately minimizes ASE, resulting in improved laser performance and the potential for new products within the optics industry.




For More Information Contact: Andy Bluvas | bluvasa@clemson.edu | (864) 656-5157 | CURF Reference No. 2011-108

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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

To learn more about this technology, please contact:

**Andy Bluvas**
Technology Commercialization Officer
bluvasa@clemson.edu
(864) 656-5157

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