Analytical Instrumentation, Methods & Materials

Single-Crystal Halide Perovskite Nanowires with Superior Performance

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WARF: P160053US01

Inventors: Song Jin, Yongping Fu, Fei Meng

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a scalable new growth method for fabricating metal halide perovskite nanowires with applications in lasing, photovoltaics and other optoelectronic technology.

Overview

Semiconductor nanowire lasers are promising building blocks in state-of-the-art photonic and optoelectronic devices due to their advantageous properties – including ultracompact size, efficient waveguiding and highly localized coherent output. One of the major obstacles limiting the potential applications of these lasers is the high lasing threshold. This makes key technical advancement difficult and imposes fundamental performance limits.

Considerable research and development has been devoted to improving nanowire quality of common inorganic semiconductors. These efforts typically require high temperature, high vacuum and other demanding growth conditions while providing little improvement.

The Invention

Metal halide perovskite-based material is emerging as a “superstar” semiconductor material for cost-effective photovoltaic applications. UW–Madison researchers have developed a practical solution growth method for producing single-crystal perovskite nanowires with superior material quality and lasing performance.

Specifically the new method is based on a facile process of low-temperature dissolution of a metal precursor film in a cation precursor solution, followed by recrystallization to form single-crystal perovskite nanostructures such as nanowires, nanorods and nanoplates. Diverse families of metal halide perovskite materials with different cations, anions and dimensionality with different properties can be made to enable high-performance device applications.

Applications

- Production of high-quality perovskite nanowires and other nanostructures
- Suitable for use in a variety of electronic, optoelectronic and photonic devices including lasers, light-emitting diodes (LEDs) and solar cells, with widely tunable wavelengths

Key Benefits

- Potential for best-in-class performance
- Growth method is scalable, simple and low temperature.

Stage of Development

Lead halide perovskite nanowires produced using this method have demonstrated the lowest lasing threshold, highest quality factor (Q) and highest quantum efficiency of any nanowire lasers known.

Additional Information

For More Information About the Inventors

- Song Jin

Related Technologies

- WARF reference number P06215US describes the researcher's method for producing single crystal metal silicide nanowires with applications in nanoelectronics, lasers and more.

Publications

- Read an article about this technology.

Tech Fields

- Analytical Instrumentation, Methods & Materials : Lasers
- Semiconductors & Integrated Circuits : Design & fabrication

For current licensing status, please contact Jennifer Gottwald at jennifer@warf.org or 608-960-9854