Researchers fabricate high-quality transparent ceramic

September 9 2020, by Zhang Nannan

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Mid-infrared lasers have been widely used in imaging, detection, diagnostics, environmental monitoring, medicine, industry, defense and others. For mid-infrared laser systems, low phonon energy gain materials

are key factors.

Among these mid-infrared materials, Er^{3+}-doped CaF_2 transparent ceramics are promising candidate materials because of their ultra-low phonon energy as well as excellent physical, chemical, and optical properties, which quickly attract the attention of researchers. However, traditional preparation methods can't obtain high-quality Er^{3+}-doped CaF_2 transparent ceramics.

Recently, a research team led by Prof. Zhang Long from the Shanghai Institute of Optics and Fine Mechanics of the Chinese Academy of Sciences has developed a high quality Er^{3+}-doped CaF_2 transparent ceramics by single crystal ceramization. Their study was published in Journal of the European Ceramic Society.

In this research, the researchers grew the 3 at% Er^{3+}-doped CaF_2 single crystal using the temperature gradient technique (TGT). The single crystal was cut into 5*5*3 mm^3 cuboid, and put into a graphite mold. It underwent plastic deformation and hot-pressing sintering in a vacuum hot press furnace, after which the researchers obtained the Er^{3+}-doped CaF_2 transparent ceramic. The ceramic sample was polished to 1 mm for characterization.

They discovered that the Er^{3+}-doped CaF_2 transparent ceramics possess an obvious polycrystalline structure, perfect transmittance, and excellent mid-infrared performance, superior to the hot-pressed and hot-formed Er^{3+}-doped CaF_2 ceramics.

In addition, the paper discusses the influencing factor for the slight change of Er^{3+}-doped CaF_2 transparent ceramics in optical performance.

More information: Yiguang Jiang et al. Er 3+ -doped CaF 2 polycrystalline ceramic with perfect transparency for mid-infrared laser,

Journal of the American Ceramic Society (2020). DOI: 10.1111/jace.17308