

Novel Beam Scanning Phenomenon Using KTN Crystal

The electro-optic crystal KTN ($\text{KTa}_{1-x}\text{Nb}_x\text{O}_3$) has been known since the 1960s as one of the best electro-optic (EO) crystals because it has a very large dielectric constant and a large EO effect and contains no hazardous or polluting materials. Nevertheless, the difficulty of its crystal growth process has prevented its use for applications.

NTT Photonics Laboratories succeeded in growing KTN crystal of a practical size in 2003 and NTT has now discovered a novel phenomenon in which an optical beam is steered by simply applying an electrical signal to KTN crystal. The injected electrons induce a gradation of reflective index inside the crystal, which causes the optical beam traveling through the crystal to be continuously and cumulatively deflected. Electron injection into EO crystal is a new concept because EO crystal has been regarded as an insulating material.

Utilizing this discovery, NTT has created the KTN beam scanner, which outperforms conventional EO beam scanners. The KTN scanner can scan an optical beam over a wide angle of 12° , which is 80 times the range of the conventional prism-type EO beam scanner operating in the same condition. In comparison

with mechanisms based on moving mirrors such as polygon mirrors and galvanic mirrors, which are widely used in laser printers and photocopiers, the KTN scanner can improve the response time by 100 times and reduce the device volume by 1/100 while achieving a comparable scanning angle.

Conventional optical beam scanners are widely used in various fields such as displays, printing, imaging, optical storage, and optical communication because they can control the direction of light. Thus, the high-performance KTN beam scanner is expected to have a wide range of application. It should also open up a new operating regime beyond the reach of conventional technologies. NTT will therefore continue developing the technology of the KTN beam scanner for further application.

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