Phase-Conjugate Mirrors in KNSBN: Cu Crystal

March, 1995

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Phase-conjugate mirrors are the devices that generate the phase-conjugate wave (time-reversed wave). This thesis has studied the most efficient optical phase-conjugate mirrors: self-pumped phase-conjugate mirror (SPPCM) and double phase-conjugate mirror (DPCM), in KNSBN: Cu photorefractive crystal.

At first, this thesis has been concerned with the SPPCM in KNSBN: Cu crystal. Based on the large photorefractive effect, a KNSBN: Cu SPPCM has been formed. The formation process of the SPPCM has been described and discussed. The thesis has emphasized the effect of self-generated fanning on the formation and performance of the SPPCM. And the behavior of the formed SPPCM has been observed and the operation mechanism of the SPPCM has been revealed. The performance of the SPPCM also has been observed and explained. The formation speed of the SPPCM has been investigated and effectively enhanced by using two cylindrical lenses. The origin and elimination of the dynamic instability in SPPCM have been initially investigated. For the first time, the origin of the dynamic instability has been revealed and the effective way to eliminate the dynamic instability has been developed.

At second, this thesis has been concerned with the DPCM in KNSBN: Cu crystal. For the first time, a stable high-efficiency DPCM has been formed in a KNSBN: Cu crystal. The highest efficiency in reported DPCMs has been achieved. The formation mechanism of and the stability of the DPCM have been discussed. The phase-conjugate imaging properties have been observed. The phenomenon of unequal two phase-conjugate transmissivities has been investigated by the experimental observation and theoretical explanation.

This thesis has investigated the phase-conjugators in KNSBN: Cu photorefractive crystal in many aspects, which will greatly contribute to their wide applications.