

RbTiOAsO₄ 결정의 주기적인 강탄성-강유전 다분역 구조를
 이용한 효율적인 준위상 정합 이차 조화파 발생
 Efficient quasi-phase-matched second harmonic generation
 using ferroelastically induced periodic ferroelectric domains in
 RbTiOAsO₄ crystals

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Quasi-phase-match (QPM) can be realized by means of one-dimensional spatial modulation of second-order nonlinear susceptibility and has advantages over the conventional bulk phase-matching method because QPM can not only utilize the largest component of second-order nonlinear susceptibility tensor, but also can circumvent walk-off effect [1].

RbTiOAsO₄ (RTA) crystals of large size ($19 \times 41 \times 20 \text{mm}^3$) and excellent quality were grown using the high temperature solution growth method at the authors' laboratory. As-grown RTA crystals showed ferroelastic-ferroelectric domains parallel to (011) or (201) planes. A compression test with a loading rate of 0.53 kPa/s showed an irreversible domain switching, which is clear evidence that the domains are ferroelastic origin. Here, we demonstrate QPM second-harmonic generation (SHG) in ferroelastically induced domains of RTA crystals for the first time.

For QPM SHG, RTA crystals with ferroelastic-ferroelectric domains were cut and polished in such a manner that the largest second-order nonlinear coefficient of $d_{33}=15.8 \text{pm/V}$ can be utilized [2]. The period of the domains was determined by etching the polished c-face of the RTA crystal with hydrofluoric acid, which varied in the range of $2.14 \mu\text{m}$ to $2.95 \mu\text{m}$ in 2.6 mm length. Using the experimental setup as shown in Figure 1, QPM SHG was observed using a pump beam of 820nm to 860 nm wavelengths (Figure 2). The fundamental and SHG powers were measured as a function wavelength (Figure 3) and the maximum second-harmonic conversion efficiency of 2.4×10^{-3} was obtained at 837.9 nm, which corresponds to an effective second-order nonlinear coefficient of 2.95pm/V .

1. J. A. Armstrong, N. Bloembergen, J. Ducuing, and P. S. Pershan, Phys. Rev. **127**, 1918(1962).
2. L. T. Cheng, L. K. Cheng, and J. D. Bierlein, SPIE, **1863**, 43(1993).

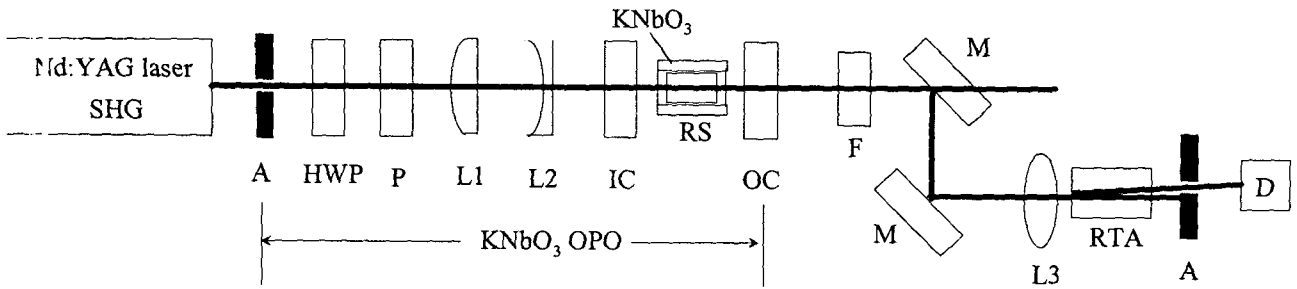


Figure 1. The experimental setup for QPM SHG using a periodically domain-inverted RTA (A: aperture, HWP: half-wave plate, P: polarizer, L1, L2, L3: singlet lenses, IC: input coupler, OC: output coupler, RS: rotation stage, F: 532 nm-filter, M: 800-900 nm mirror, D: detector).



Figure 2. Quasi-phase-matched second-harmonic generation in a periodically domain inverted RTA.

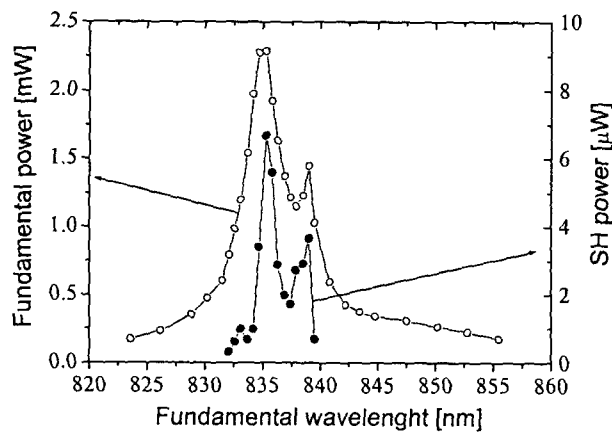


Figure 3. The fundamental and second harmonic powers as a function of wavelength.