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POLED OPTICAL FIBRES FOR QUASI-PHASE-MATCHED BLUE-LIGHT GENERATION: RECENT DEVELOPMENTS

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Recent developments in quasi-phase-matched cw blue light generation in poled optical fibres are reported. An increase of a factor ~10 in the conversion efficiency in comparison with the previous results is obtained.

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Recently, periodically patterned second order nonlinearities have been created in optical fibres by thermal poling in vacuo and cw quasi-phase-matched frequency conversion to the blue has been demonstrated [1]. The maximum blue light power detected was ~400 pW, corresponding to a fundamental power in the fibre of ~100 mW. Here we report recent developments in cw blue light generation in poled optical fibres. An increase of a factor ~10 in the conversion efficiency in comparison with the previous results has been obtained.

A cw Ti:sapphire laser was used to test the fibres thermally poled in vacuo via a periodic anode 6 mm long. Fibres, whose core region was located between 1 and 4 μm from the side-polished surface, were tested. The dependence of the SH power on the pump wavelength in the fibre with a small (1 μm) core-surface distance show a well defined main peak (LP_{00}^{ω} -$LP_{00}^{2\omega}$ interaction) at 880 nm of ~2.6 nm bandwidth, together with a weak side peak at 860 nm (LP_{00}^{ω}-$LP_{01}^{2\omega}$ interaction). The measured bandwidth for the phase-matching peaks is approximately 2 times larger than the theoretical estimate. The maximum blue light power detected was ~10 nW corresponding to a fundamental power in the fibre of ~230 mW. We have observed that in fibres with core-surface distance larger than 1 μm the LP_{00}^{ω}-$LP_{01}^{2\omega}$ interaction was stronger than the LP_{00}^{ω}-$LP_{00}^{2\omega}$ interaction. The quality of the $\chi^{(2)}$ grating was also tested by propagating the pump perpendicular to the fibre. The fibre showed well defined periodic structure regions as well as regions where the nonlinear grating was absent. Considerable improvements in the conversion efficiency are expected by improving both the value of the nonlinearity and the quality of the periodic structure.

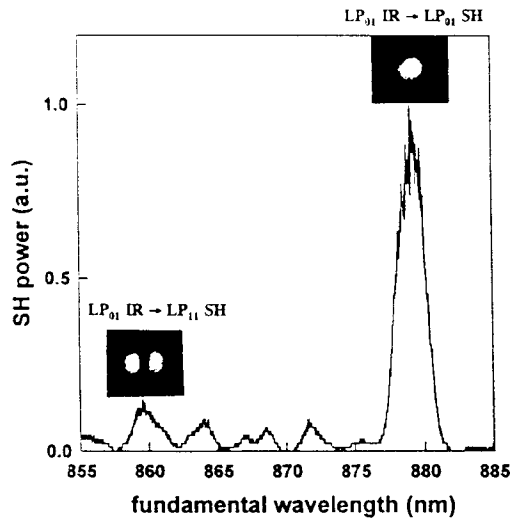

Fig.1 Wavelength dependence.

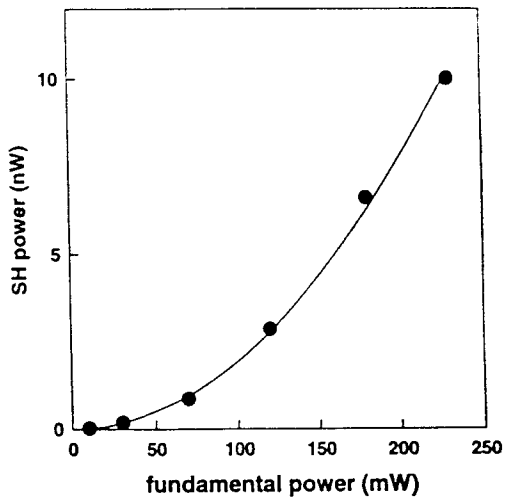

Fig.2 Dependence of SH power on pump power.

References

1. P.G. Kazansky, V. Pruneri and P.St.J. Russell, Opt. Lett. **20**, 843 (1995).