Broadband red, green and blue light sources for speckle noise reduction on laser projection display

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The laser projection display system offer a lot of advantages over conventional projcetors. However, laser light source cuase the speckle noise that is pattern of random interfernce due to scattered coherence light from rough screen. We solve the problems by decreasing the coherence length from light source.

In order to broaden the spectral bandwidth of laser light source, we propose the aperiodically poled lithium niobate structures (APPLN) that consists p segments so that each segment is made up n_i domain pair with constant period [1,2]. To obtain the 5nm of spectral bandwidth by each red, green and blue lights using quasi-phase matching (QPM) samples, we degined the range of period that is 12.14 to 12.4μm, 6.56 to 6.76μm and 5.03 to 5.21μm, with sample length of 8mm. However, ripple is generated by APPLN due to the constituent phase-matching spectra originating from different positions in the samples. To reduce the ripple, adjust the duty ratio (the raido of poled dodamin area to unpoled original domain area) conventionally. Poled domain size is very small due to small duty ratio. It makes actual problem of the sample fabrication. We applied a novel idea to solve the problem by adjusting the number of domain pair and obtained spectral bandwidth is 4.1nm for red color, 4.7nm for green color and 5.0nm for blue color. In addition, we achieve that apodization reduce ripples by approximately 50%. Fig. 1 shows that we achieved the develoment of the speckle free light source based on tandem poled lithium niobate.

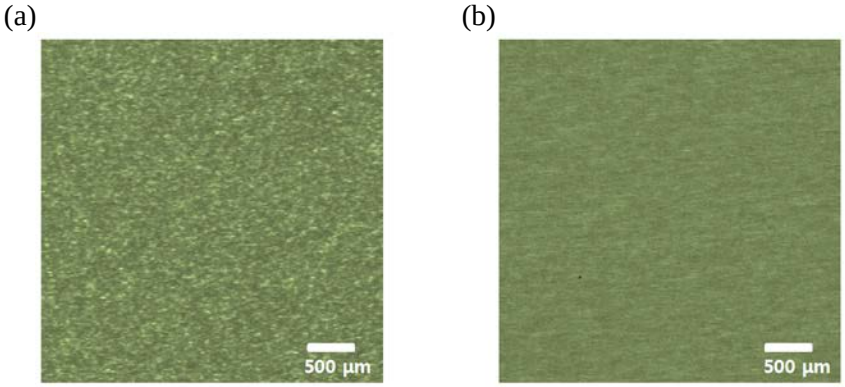

Fig. 1. Speckle pattern of (a) periodically poled lithium niobate sample and (b) tandem poled lithium niobate sample in green light

In summary, we developed tandem poled lithium niobate for boradband second harmonic generation with tandem QPM period.

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