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## Efficient polarization splitter-rotator on thin film lithium niobate: supplemental document

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**Fabrication process.** The PSR is fabricated on a commercial X-cut LNOI wafer (NANOLN). The fabrication process shown in Fig. S1 is detailed as follows:

(i) The LNOI chip is cleaned by acetone and IPA.

(ii) A 180 nm thick Cr film is deposited on LNOI by electron-beam evaporation (EBE) process.

(iii) Electron beam lithography (EBL) process is used to define the device.

(iv) The pattern is transferred to the Cr by a chlorine-based inductively coupled plasma (ICP) process.

(v) The patterned Cr is used as a hard mask to etch LN with an etching depth of 260nm and etching time of 4 min, where the argon-based inductively coupled plasma reactive-ion-etching (ICP-RIE) process is used.

(vi) The remaining Cr mask is removed by chromium etchant, after that a silica cladding with the thickness of 1 µm is deposited by plasma enhanced chemical vapor deposition (PECVD).



Fig. S1 The schematic of the fabrication process.

**Grating couplers measurement.** The TE-type and TM-type grating couplers are shown in Fig. 5(a) in manuscript. The configuration of the test system is shown in Fig. S2. A tunable laser (Santec TLS-510) is used as the light source in the measurement. After polarized by a polarization controller (PC), the light is coupled into and out of the chip by a vertical coupling system. The output light is finally detected by an optical power meter (YOKOGAWA AQ2211). When testing the TE-type grating coupler, the light passes through a straight waveguide with TE-type grating couplers at both ends on the chip. Adjusting the PC carefully, we can get a maximum value of the optical power meter. Then we account that TE mode light

is coupled into the waveguide. Conversely, TM mode light is coupled into the waveguide when observing a minimum value of the optical power meter. TM-type grating coupler is tested by the same way. The transmission spectra of the testing grating coupler-waveguide-grating coupler structure are shown in Fig. S3. The length of the fabricated straight waveguide between two grating couplers is about 600 µm, and the propagation losses of the waveguides fabricated by our group are about 0.99dB/cm±0.11dB/cm for TE0 mode and 1.54dB/cm±0.13dB/cm for TM0 mode, respectively[1]. After calculation, the measured coupling losses of TE-type and TM-type grating couplers are 6.15 dB and 8.65 dB at 1550 nm, respectively. The polarization extinction ratios of both grating couplers are only 10 dB at some wavelength, we think it does not affect the measurement. Because the polarization state of the input light is determined by the PC, grating couplers are used to confirm if it is currently adjusted to TE or TM mode. Thus we can ensure that TE or TM mode light is injected into waveguide.



Fig. S2 The configuration of the grating couplers test system.



Fig. S3 (a) The transmission spectrum of straight waveguide with two TE-type grating coupler. (b) The transmission spectrum of straight waveguide with two TM- type grating coupler.

## References

1.

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