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Abstract
In this study, we proposed a Zn-indiffused mode converter fabricated in an -x-cut z-propagation lithium niobate substrate for the first time. The proposed converter was verified that it can operate at a wavelength of 633 nm. It has a stable conversion efficiency of about 99.5% from the input TM polarization to the converted TE one, when it works at the phase-matching voltage of 12V, and mode-conversion switching voltages of 5 V. On the other hand, this converter can still keep the maximum conversion efficiency in a period of 60 min measurement.
During the long-term measurements, although this converter has maximum conversion efficiency at the mode-conversion voltage of 6 V, the maximum conversion efficiency only keeps in the beginning of the measurement. Because of the photorefractive effect, the efficiency will reduce when it works for a long time. In this study, we used the structure of the converter to treat it as a phase modulator, and also fabricated a phase modulator with Ti-indiffused waveguides in the same geometry substrates. Then we compared their operation stabilities under the impacts of the photorefractive effect. The results show that the power-handing stabilities of Zn-indiffused waveguides are better than that of the conventional Ti-indiffused waveguides.
In addition, we used a method of biased-voltage and laser-trimming to suppress effectively the photorefractive effects in the Zn-indiffused mode converter. After treatments, the maximum conversion efficiency is stable even using a higher irradiating power of 80 w in a measurement period of 60 min. The improvements are achievable resulting from the stable phase-matching conditions of mode converter after treatments. This effect is attributed to a permanent lowering of the amount of photo-excitable electrons in the channel waveguide. Although the applied voltages of complete conversion are increased from 5V to 8V after treatments, the carrier-depletion effects to suppress the phase-bias drift are still worthwhile evaluations for improving stability of mode converter operating in short wavelengths.
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