

3.3 Novel Non-destructive Waveguide Loss Measurement Method

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Waveguide loss is one of the key parameters for the fabrication of efficient guided wave devices such as frequency doublers and electro-optic modulators. There exist quite a lot of different loss-measurement methods, such as cut-back for optical fibers (destructive), Fabry-Perot (requires single mode lasers), Prism coupling method (requires a minimum length of the waveguide of several centimetres) and many others. But most of them are not adequate for waveguides in nonlinear optical materials such as KTiOPO_4 (KTP), KNbO_3 , and BaTiO_3 where the sample lengths are typically limited to 5 - 10 mm. Therefore we have developed a novel non-destructive waveguide loss measurement method that is based on optimum end-fire back transmission provided by self-pumped phase-conjugation in a photorefractive BaTiO_3 or KNbO_3 crystal. This method avoids the problem of unknown coupling efficiency for the second pass through the waveguide that occurs in single-pass transmission loss measurements because the phase-conjugate of the out-coupled waveguide mode is coupled back into the waveguide with 100% efficiency. Our end-fire back transmission method is quite universal and can be used at any wavelength where photorefractive crystals provide optical phase-conjugation, e.g. in the visible and near-infrared spectral range.