Acoustooptically Tunable Waveguide Lasers in Erbium Doped Lithium Niobate

Integrated acoustooptically tunable lasers have been developed in an Er-doped, Ti-indiffused Lithium Niobate waveguide. An acoustooptical (AO) filter is monolithically integrated inside the laser cavity as a wavelength selective element. It consists of two polarization splitters and an AO polarization converter in between. A surface acoustic wave (SAW) induces a polarization conversion at a selected optical wavelength which is then separated by the polarization splitter. This conversion process is accompanied by a frequency shift of the converted optical wave by the frequency of the driving SAW. A second AO polarization converter can be used to compensate this shift. Two types of lasers are investigated: a Frequency Shift Compensated (FSC) laser and a Frequency Shifted Feedback (FSF) laser.

The lasers are optically pumped by a laser-diode of 1480 nm wavelength. The tuning range is identical for both lasers. They are tunable from 1530 nm to 1570 nm with a slope of 8.2 nm/MHz by varying the SAW frequency around 170 MHz. The FSC laser shows a single mode emission with a measured linewidth of 12 pm. More than 0.5 mW of laser output power is obtained in the wavelength range around 1560 nm with an input pump power of 130 mW. In the FSF laser operation, a spectral linewidth of about 180 pm is observed at an input pump power level of 95 mW. Unique features of the FSF laser emission are studied: the output spectrum consists of a comb of chirped (at the rate of 2.43×10^{17} Hz/s) frequency components with a regular spacing equal to 711 MHz (corresponds to the free spectral range of the laser cavity). As an application of such an FSF laser, optical frequency domain ranging (OFDR) is demonstrated.