Poling of planar silica-based waveguides - DTU Orbit (10/11/2019)

Poling of planar silica-based waveguides

Planar silica-based waveguides were electrically poled at elevated temperatures and cooled with the field still applied. This procedure induced second-order nonlinear effects in the waveguides. Systematic studies of the dependence of the induced linear electro-optic effect on poling temperature and the poling voltage were performed using a negative voltage on the top electrode. It was found that the optimum poling temperature is -430 C. A linear dependence of the induced linear electro-optic effect on the voltage was observed. The largest measured linear electro-optic coefficient was 0.07 pm/V. A model study of the negative poling process showed that it is likely that charges build up at interfaces between core and cladding glasses during poling. The model predicted with good agreement the size of measured linear electro-optic effects and the depth profile of the second-order optical nonlinearity recorded with spatially resolved second-harmonic generation. Very large second-harmonic signals were obtained when poling with a positive voltage on a painted-on top electrode. Calibration of the signals to GaAs showed that the second-order nonlinear susceptibility of the poled glass corresponds to -48 pm/V. In contrast, only small linear electro-optic effects were detected in the same waveguides. Characterization of the poled samples by Secondary Ion Mass Spectrometry (SIMS) showed that large amounts of positive ions, in particular Ag ions, are injected into the samples during poling.