Abstract

Long distance optical communication systems experience a large degree of attenuation due to fibre losses, necessitating signal amplification. Erbium Doped Fibre Amplifiers (EDFAs) have found widespread use as all-fibre optical amplifiers, but exhibit unequal amplification of different wavelengths. Since the gain spectrum is signal-power and pump-power dependent, each EDFA spectrum may differ considerably, and a tuneable gain equalizer is required. A tuneable long-period grating (LPG) can be implemented as a gain equalizer for EDFAs.

This dissertation deals with the design of an integrated optic version of the tuneable equalizing filter. The various components of which the device comprises, including optical couplers, Mach-Zehnder interferometers and an LPG, are investigated. The integrated optics designs of these components are then done using the BeamPROP software package. The use and optical properties of germania-doped silica as photosensitive waveguide material is studied. The production of the films for the gain equalizer, using electron-cyclotron resonance plasma-enhanced chemical vapour deposition, is discussed. Characterization of these films was carried out using spectroscopic ellipsometry and infrared spectroscopy. The optical constants, thickness, germania content and hydroxyl absorption was calculated using these measurements.

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