MEASUREMENT AND APPLICATIONS OF DISPERSION IN EPITAXIAL II-VI SEMICONDUCTOR THIN FILMS AND MULTILAYERS

Abstract

by

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In this thesis we investigate the dispersion of the indices of refraction of II-VI semiconductors, and explore a series of materials combinations which are suited for the fabrication of distributed Bragg reflectors (DBRs). A prism coupler method and reflectivity measurements were used to determine the indices of refraction n of II-VI semiconductor ternary alloys of various compositions prepared by molecular beam epitaxy (MBE). We show that the prism coupler technique, which is capable of measuring n with an accuracy of at least 0.1% at discrete wavelengths, and simultaneously to determine the thickness of the layers with an uncertainty of less than 0.5%, is a very reliable, convenient, and accurate tool for determining compositions and growth rates for MBE. Using the highly accurate values of n obtained from the prism coupler and reflectivity measurements, we have fabricated several DBRs using different II-VI materials. From our work on DBRs, we have obtained a structure (i.e., a 20-period ZnMgSe/ZnCdSe multilayer) which yields 98% reflectivity. This is to our knowledge the highest reflectivity reported for a DBR in the II-VI semiconductor camp. Motivated by this work, we show preliminary results of monolithic microcavities which are fabricated by integrating these high-reflectivity DBRs.