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Reflectance Spectra of Plasmon Waveguide Interband Cascade Lasers ROBERT HINKEY, ZHAOBING TIAN, RUI YANG, TETSUYA MISHIMA, MICHAEL SANTOS, University of Oklahoma — Non-invasive reflectivity measurements have been explored as a method for measuring the carrier concentrations of the Si-doped cladding layers of Plasmon-Waveguide Interband Cascade (IC) Lasers. We present measurements and modeling done both on the IC laser structures, as well as highly doped InAs films grown on GaAs substrates that were used to calibrate the Molecular Beam Epitaxy growth. We have found that there is a sharp drop in the signal of the reflectance spectrum for p- polarized light oscillating near the plasma frequency, which falls in the mid-infrared for the cladding layers of the laser structure. This feature in the spectrum is caused by the interaction of the incident light with collective plasmon modes, and is distinct from the plasma edge feature seen in the reflectance spectrum of semi-infinite samples. A similar "plasma absorption" effect has been observed in thin metal films in the ultraviolet. The doping concentration and layer thicknesses of the structure were obtained by fitting a modeled curve to the measured spectrum. We were able to obtain measurements of the cladding layer doping concentrations (in a range from 10^{18} to 10^{19} cm^{-3}) with values that were in good agreement with those found using Hall effect measurements. We will discuss how these results can aid in improving the design of mid-infrared plasmon waveguide lasers.

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