Ion Implantation and Alternative Microdisk Laser Design of Integrated Optical Cancellation System

Jenny Sun, Ethan Gordon, Matt Chang, and Paul Prucnal
Princeton University, Princeton, NJ 08544, USA
Author email: jingyis@princeton.edu

Introduction

To counter the problem of self-interference in radio transmission, the Optical Cancellation System (OCS) project implements self-interference cancellation in order to allow transmit and receive on the same channel [1]. The OCS accomplishes this by directly modulating the transmit signal onto optical signals from a laser, modifying the amplitude and phase of the signal to maximize destructive interference, and then combining the current signals of the photodetectors to achieve cancellation.

Current Progress

The OCS has been integrated onto a chip and is undergoing revisions, including: 1) ion implantation for the purpose of improving electrical isolation between devices and 2) microdisk laser design for better mode separation, potentially solving problems such as optical beating noise and saving valuable chip space. Results ion implantation simulations and preliminary design of microdisks are shown in Figures 1 and 2, respectively.

Fig. 1. (A) Existing integrated OCS design. Cross-current occurs between devices, making on-chip tuning components ineffective. (B) TRIM (Transport Of Ions In Matter) simulation destruction profile of iron ion bombardment at 4MeV. Hydrogen, helium, oxygen, and iron ion bombardment through a 5μm InP wafer were simulated at implantation energies from 50keV to 4MeV. We determined that iron implantation at 50keV and 3MeV would provide the best electrical isolation at all depths given existing technologies.

Fig. 2. Section of microdisk mask design. Variations in geometries, disk radius, waveguide width, and contact designs will be fabricated and tested, as well as several integrated microdisk OCS designs. First number label indicates radius in micron, second number label indicates waveguide width in micron, and “P” or “E” indicates option of waveguide pumping for each microdisk.