Polarization-Insensitive Broadband Grating Coupler on Germanium on Insulator (Ge-OI) and Silicon Nitride on Insulator (SiN-OI) - A comparative Study

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Abstract:
The horizon of near to mid-Infrared photonics expands after Germanium and Silicon Nitride materialization. Lately, these materials have attracted much interest because of their inherent properties, like a transparency window of 2-12 µm for germanium and 0.25-8 µm for silicon nitride, and its complementary metal-oxide-semiconductor (CMOS) compatibility. Concerning edge coupling, Grating couplers (GC) represent a desirable solution since they can be placed anywhere on the chip, allowing simple wafer-scale automated testing and providing much wider alignment tolerance. In this work, we have comparatively studied and designed a novel bilayer Grating Structure for germanium, and silicon nitride optimized using Finite difference Time Domain (FDTD) software. In this suggested structure, we have chosen a waveguide of height and width of 500 nm for Ge and 500 nm,600 nm for SiN for the confinement of mode required and optimized the grating by varying the tooth angle, etch depth, and period for each. We have also designed and optimized Bragg reflectors for each platform to maximize the coupling efficiency. The proposed novel trapezoidal bilayer grating structure on the GeOI platform couples 70 % of Transverse Electric (TE) and 60 % of Transverse Magnetic (TM) modes. The same design for SiN-OI results for 43% of TE and 53% of TM, respectively. The 3-dB Bandwidth of TE and TM for Ge-OI structure was 30nm and 40nm, while the same spectral response for SiN-OI was 210nm for TE and 150nm for TM. Thanks to the optimized design, these results represent the best performance reported in the literature for Ge-OI structures without using any back-reflector. SiN-OI and Ge-OI polarization independent grating coupler designed here can be widely used in optical communication, optical information processing, and optical sensing.

Biography:
Arpita Mishra joined the Indian Institute of Science as a Ph.D. Scholar in the Department of Electrical communication engineering. Before pursuing a Ph.D. She was a Project Staff at IISc. She received her M.Tech from IIIT, Bhubaneswar. Her primary research interests are in the field of Integrated Photonics based Sensors. In her free time, she practices yoga and explores the city for good vegetarian cuisine and instances of public art.