

On-Chip Soliton Generation

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Principal Investigator(s): Jaime Cardenas

User(s): Arunima Nauriyal and Sushant Kumar

Affiliation(s): University of Rochester, Institute of Optics

Contact: jaime.cardenas@rochester.edu, anauriya@ur.rochester.edu

Primary CNF Tools Used: PECVD, LPCVD Furnace, Electron beam

lithography JEOL 9500, ASML, Oxford 100, Unaxis, dicing saw, Piranha, YES eco clean

Abstract:

Development of on chip soliton generation using dispersion management. Carefully designing the waveguides by manipulating the dispersion properties of silicon nitride. Improving fiber to chip coupling efficiency by integrating mode converters [Fig. 1] to improve on chip soliton properties.

Summary of Research:

We achieved our goal of getting high energy anomalous dispersion soliton on chip. For a smoother surface we deposited TEOS using PECVD followed by the twist and grow method [1] in E4 furnace for LPCVD of thick nitride to manage nitride stress. Double pass writing was used in JEOL 9500 for higher precision and Q factor. To ensure we have no air gaps between the ring resonator and the bus waveguide we deposit HTO in furnace followed by TEOS deposition in PECVD as the upper cladding. The next step was using ASML lithography to pattern mode converters [2] on our wafer to maximize chips to fiber coupling. Etching oxide and nitride layers were done using the OXFORD 100 standard recipes. Silicon etching was performed using the Unaxis as Versaline was down, this was then followed by undercutting the wafer using Xenon difluoride. Many of these devices are under testing so we do not have results on the device performance yet.

Conclusions and Future Steps:

Our novel method for generation of solitons on chips was carefully and successfully implemented by using the tool available to us by CNF. We will be working on improving the devices to achieve higher peak power solitons and help the academic industry grow in knowledge.



Figure 1: Mode converter Top view

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References:

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- [2] Juniyali Nauriyal, Meiting Song, Yi Zhang, Marissa Granados-Baez, and Jaime Cardenas, "Fiber array to chip attach using laser fusion splicing for low loss," Opt. Express 31, 21863-21869 (2023).

