Mode-controlled Nanowire Laser and the Chip-Integration

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Nanowire lasers have compact structures that are easy to integrate and have extremely low power consumption. They have wide-ranging applications in on-chip communication, sensing, and detection. In the field of optical communication, the output mode of lasers is very important. For example, designing narrow linewidth and single longitudinal mode output lasers can avoid pulse broadening and signal crosstalk caused by multi-frequency output, increasing communication bandwidth. Designing lasers with different transverse modes output can increase communication capacity by mode reuse. However, existing nanowire lasers often have larger geometric dimensions to improve their optical gain, limiting their mode control. This report introduces research progress on mode control of nanowire lasers in our research group. We combined numerical simulation software to design nanowire geometric structure parameters and selectively grew InGaAs/InP quantum disk nanowires by metal organic compound chemical vapor deposition, achieving near-infrared emission and stable single longitudinal mode output nanowire lasers. In addition, by controlling the pattern of the selective growth of the graphically patterned substrate, we achieved transverse mode controllable and vector emission nanowire vertical cavity surface emitting lasers. Lastly, the developed strategies of integrating nanowire lasers in photonic integrated circuits would be discussed.

Short Bio:

Xuetao Gan, a professor and doctoral supervisor at Northwestern Polytechnical University, is an

"Outstanding Young" recipient of the National Natural Science Foundation of China, currently serving as Secretary of the Party Committee of the School of Microelectronics and Director of the Key Laboratory of Optofield Control and Information Sensing Industry and Informatization. He mainly researches micro-nanophotonics and integrated optoelectronic devices. He has published more than 150 SCI papers, including more than 100 papers as first or corresponding author in journals such as Nature Photonics, Science Advances, Nature Communications, Light Science & Applications, Optica, Advanced Materials, Advanced Functional Materials, Nano Letters, ACS Nano, and Laser Photonics Reviews