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Presents

ZnO light-emitting diodes and laser diodes

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In this paper, we present our recent works on ZnO light-emitting devices including homojunction nanorod light-emitting diodes, optically pumped whispering-gallery-mode (WGM) lasing and electrically driven WGM heterojunction laser diodes.

Firstly, by applying plasma immersion ion implantation to modify the surface of ZnO nanorods grown from pure Zn and oxygen without catalyst, we found that the electronic defects only reside on the surface. This makes them easy to be doped to p-type. Then by ion implantation of As and P, we realized efficient pure UV emitting LEDs. For optically pumped WGM lasing, we clearly observed the evolution from spontaneous to stimulated emission from ZnO disks. The lasing process has pronounced excitonic signature, that is, inelastic exciton-exciton scattering. The observed lasing modes match well with the theoretical values derived from WGM lasing. The proof-of-concept sensing application based on ZnO WGM lasing is also demonstrated. Lastly, we fabricated the ZnO microrod/GaN heterojunction laser diode, the EL emission mechanism for this diode was discussed. At the current 12 mA, the WGM lasing with distinct multiple-mode structure was realized. This study indicates that the hexagonal ZnO microstructure is of potential in microlaser diodes.



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