

## Comparative study of photoluminescences for Zn-polar and O-polar faces of single-crystalline ZnO bulks

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**Abstract** : The authors have an extensive study of photoluminescences for Zn-polar and O-polar faces of single-crystalline ZnO bulks. In the photoluminescence (PL) spectra at 10 K, Zn-polar and O-polar faces show a common emission feature: neutral donor-bound excitons and their longitudinal-optical (LO) phonon replicas are strong, and free excitons are very weak. However, in the PL spectra at room temperature (RT), Zn-polar and O-polar faces show extremely different emission characteristics: the emission intensity of Zn-polar face is 30 times larger than that of O-polar face, and the band edge of Zn-polar face is 33 meV red-shifted from that of O-polar face. The temperature dependence of photoluminescence indicates that the PL spectra at RT are closely associated with free excitons and their phonon-assisted annihilation processes. As a result, it is found that the RT PL spectra of Zn-polar face is dominated by the first-order LO phonon replica of A free excitons, while that of O-polar face is determined by A free excitons. This is ascribed that Zn-polar face has larger exciton-phonon coupling strength than O-polar face.

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