
Zinc Alloys for the Fabrication of Semiconductor Devices **Materials improve the performance of semiconductor devices.**

Goddard Space Flight Center, Greenbelt, Maryland

ZnBeO and ZnCdSeO alloys have been disclosed as materials for the improvement in performance, function, and capability of semiconductor devices. The alloys can be used alone or in combination to form active photonic layers that can emit over a range of wavelength values.

Materials with both larger and smaller band gaps would allow for the fabrication of semiconductor heterostructures that have increased function in the ultraviolet (UV) region of the spectrum. ZnO is a wide band-gap material possessing good radiation-resistance properties. It is desirable to modify the energy band gap of ZnO to smaller values than that for ZnO and to larger values than that for ZnO for use in semiconductor devices. A material with band gap energy larger than that of ZnO would allow for the emission at shorter wavelengths for LED (light

emitting diode) and LD (laser diode) devices, while a material with band gap energy smaller than that of ZnO would allow for emission at longer wavelengths for LED and LD devices.

The amount of Be in the ZnBeO alloy system can be varied to increase the energy bandgap of ZnO to values larger than that of ZnO. The amount of Cd and Se in the ZnCdSeO alloy system can be varied to decrease the energy band gap of ZnO to values smaller than that of ZnO. Each alloy formed can be undoped or can be p-type doped using selected dopant elements, or can be n-type doped using selected dopant elements.

The layers and structures formed with both the ZnBeO and ZnCdSeO semiconductor alloys — including undoped, p-type-doped, and n-type-doped types — can be used for fabricating photonic and electronic semiconductor

devices for use in photonic and electronic applications. These devices can be used in LEDs, LDs, FETs (field effect transistors), PN junctions, PIN junctions, Schottky barrier diodes, UV detectors and transmitters, and transistors and transparent transistors. They also can be used in applications for light-emitting display, backlighting for displays, UV and visible transmitters and detectors, high-frequency radar, biomedical imaging, chemical compound identification, molecular identification and structure, gas sensors, imaging systems, and for the fundamental studies of atoms, molecules, gases, vapors, and solids.

This work was done by Yungryel Ryu, Tae S. Lee, and Henry W. White of MOXtronics for Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-15634-1