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Raman scattering investigations on Co and Mn doped ZnO epitaxial films: local vibration modes and defect associated ferromagnetism[1]
QIANG CAO, GUOLEI LIU, SHISHEN YAN, LIANGMO MEI, Shandong University — The studies of local vibration modes (LVMs) of Co or Mn substitution in wurtzite ZnO lattice have been rather limited, and evolution of LVM bound defects as well as associated ferromagnetism are still poorly understood.In this paper, Raman scattering spectroscopy has been performed on high quality Co and Mn doped ZnO epitaxial films, which were grown on Al_2O_3(0001) by oxygen-plasma assisted molecular beam epitaxy. Raman measurements revealed two local vibration modes (LVMs) at 723 and 699 cm$^{?1}$ due to the substitution of Co^{2+} in wurtzite ZnO lattice. The LVM at 723 cm$^{?1}$ is found to be an elemental sensitive vibration mode for Co substitution. The LVM at 699cm^{-1} can be attributed to enrichment of Co^{2+} bound with oxygen vacancy, the cobalt?oxygen vacancy?cobalt complexes, which associated with ferromagnetism. It reveals two competitive local vibration modes (LVMs) at 712 and 523 cm^{-1} due to the substitution of Mn ions in wurtzite ZnO lattice. The LVM at 712cm^{-1} is found to be an elemental vibration mode of Mn substitution in wurtzite ZnO lattice, while the LVM at 523cm^{-1} can be attributed to the local vibration mode of acceptor bound Mn substitution in wurtzite ZnO lattice.

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