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Investigation of Observating the role of orbital angular momentum with in Rashba and Dresselhaus effects system SOOHYUN CHO, WONSIG JUNG, BEOMYOUNG KIM, GARAM HAN, Yonsei University, MATS LEANDERSSON, BALASUBRAMANIAN THIAGARAJAN, MAX Laboratory, CHANGYOUNG KIM, Yonsei University, MAX LABORATORY COLLABORATION — In our previous studies of Au(111) surface states with circular dichroism angle-resolved photoemission spectroscopy (CD-ARPES), we found strong CD signal, indicating probable existence and role of orbital angular momentum (OAM) in the Rashba effect. We proposed that OAM plays a key role in the electronic structures of such systems in the presence of inversion symmetry breaking and spin-orbit coupling (SOC). Semiconductors with the zinc blende structure with an inversion symmetry breaking have band splitting near the Γ-point as predicted by the band calculation. In addition, the overall spin structure can be understood in within the Dresselhaus effect. While the net OAM in the bulk should be normally zero for semiconductors with an inversion symmetry, non-zero OAM can appear in the bulk of zinc-blende structures due to the inversion symmetry breaking. Moreover, as for ARPES experiments, the sample surface provide an additional inversion symmetry breaking. To investigate the OAM structure, we have performed CD-ARPES experiments on InSb, CdTe and GaAs. Our results show CD signal in the J_{eff} =3/2 states (heavy and light hole band). We attribute the CD modulations of the three bands (heavy hole, light hole and split-off bands) to the existence of OAM. The OAM structure deduced from the CD-ARPES results is explained if we assume both the Rashba (from surface) and Dresselhaus (from bulk) effects are present. These results suggest that OAM also plays a role in the Dresselhaus effect through SOC.

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