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Band Alignment of PEALD Al2O3 and SiO2 Dielectric Passivation Layers on Zinc Oxide[1] MANPUNEET KAUR, ROBERT NEMANICH, Arizona State Univ — Zinc Oxide (ZnO) is an efficient photocatalyst for water splitting and cleaning organic waste despite its UV bandgap due to a high absorption coefficient. However, ZnO undergoes photocorrosion under UV illumination in electrochemical solutions, which hinders its application. This research is focused on measuring the band alignment of dielectric layers on ZnO which can allow carrier tunneling to the surface while passivating the surface to limit photocorrosion. In this study, we prepared plasma enhanced atomic layer deposited (PEALD) 2 nm Al2O3 and SiO2 films on O-face ZnO. The band gaps of ZnO, Al2O3 and SiO2 are 3.4 eV, 6.5 eV and 8.9 eV, respectively. Prior to deposition the ZnO surfaces were cleaned with a mixed He and O2 plasma at 310 C. In situ XPS and UPS were used to determine the Al2O3/ZnO and SiO2/ZnO band alignment. The PEALD process results in excess oxygen and negative charges in the dielectric layer, which are removed by an in situ annealing in N2 following PEALD deposition. Upward band bending in ZnO was observed after deposition of Al2O3 and SiO2; however, after annealing a flat band structure was achieved in ZnO. The Al2O3/ZnO and SiO2/ZnO measured valence band offset is 1.1 eV and 1.0 eV and conduction band offset is 2.2 eV and 3.2 eV, respectively.

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Manpuneet Kaur
Arizona State Univ

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