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Carboxylic Acid Modification of Etch-Resistant $Zn_{1-x}Mg_xO$ for Interface Tuning and Dye Sensitization[1] THOMAS BRENNER, ERICH MEINIG, GANG CHEN, THOMAS FURTAK, REUBEN COLLINS, Colorado School of Mines, Golden, CO, THOMAS FLORES, Stanford University, Stanford, CA, DANA OLSON, National Renewable Energy Laboratory, Golden, CO — The bonding of carboxylic acids to metal oxide surfaces is an important monolayer modification scheme for tuning the properties of these surfaces in organic electronic devices and dye sensitized solar cells (DSSCs). However, the commonly used transparent semiconductor ZnO is very sensitive to acids and employment of carboxylic acids on its surface leads to etching, resulting in a non-ideal layer. This is especially troublesome in ZnO-based DSSCs where the products of etching accumulate on the surface and act as 'photon parasites', reducing device efficiency. We have found that, while the electronic properties are similar, the etch rate of $Zn_{1-x}Mg_xO$ (ZnMgO) alloys decreases with Mg content and is up to 10 times smaller (at x=0.2) than that of ZnO when exposed to the modifier benzoic acid (BA). IR spectroscopy shows that BA forms a surface-bonded monolayer on ZnMgO after which etch products begin to accumulate on low (x=0-0.1) Mg content films. We suggest that ZnMgO may make a good replacement for ZnO where carboxylic acid modifiers are commonly used. In DSSCs we expect the etch resistance of ZnMgO to reduce the accumulation of 'photon parasites.' UV-Vis and photoluminescence measurements of dye-soaked ZnMgO show that the accumulation rate is reduced compared to ZnO.

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