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THE STABILIZATION OF CUPROUS OXIDE—LIQUID JUNCTION SOLAR CELLS WITH MONOLAYERS OF ADSORBED ALCOHOLS

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Polycrystalline semiconductor—liquid junction photocells are receiving much attention as promising devices for conversion of solar energy or photosynthesis of fuels. However, such systems are plagued with instability arising from photocorrosion of the semiconductor surface. Even in the presence of a regenerative redox electrolyte with efficient electron or hole quenching properties the photoelectrodes slowly degrade from secondary

reactions. In our studies on fast corroding cuprous oxide—liquid junction photocells it is found that monolayers of long chain normal aliphatic alcohols resist photocorrosion of cuprous oxide in aqueous KSCN. The mechanism of photocorrosion inhibition is identified to be the prevention of direct contact between reactive ions and free radicals with the semiconductor surface, by the monolayer, while allowing electron transfer by quantum mechanical tunnelling. It is also noted that the adsorbed alcohol monolayer increases the efficiency of the cell by stopping short circuiting at the photocathode. The monolayer remains active almost indefinitely, longer the chain length of the alcohol greater is the increase in efficiency. Monolayers of methanol, ethanol, n-propanol, n-pentanol, n-hexanol and n-octanol are found to increase the efficiency approximately by factors of 1.8, 2, 2.2, 2.3, 2.6, 2.9 respectively. The intrinsic efficiency of the cell depends on concentration of the electrolyte and the pH, the highest efficiency achieved with n-octanol is approximately 1.5%.