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CONFERENCE ON SOLAR ENERGY: THE SCIENTIFIC BASIS.

AT THE

UNIVERSITY OF ARIZONA, TUCSON.

1955 OCTOBER 31 AND NOVEMBER 1,

MONDAY AND TUESDAY.

AREAS FOR IMPROVEMENT OF THE SEMICONDUCTOR SOLAR ENERGY CONVERTER.

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SECTION C Business Administration Building ROOM 110

DAY Tuesday HOUR 12:00 Noon

ABSTRACT

Departure of the semiconductor solar energy converter from ideal performance is caused primarily from surface reflectivity, transmission of incident energy past the active portion of the cell, recombination, forward current through the junction which does not appear in the external circuit and the energy distribution of sunlight as related to the band gap of the material. Methods of reducing these losses are discussed. A novel cell construction is proposed which offers a higher theoretical conversion efficiency than current types.

INTRODUCTION

Several descriptions of the semiconductor solar energy converter and its theoretical limit of efficiency have recently been published. [1,2,3,4] Most attention has been directed toward the silicon p-n junction cell first described by Chapin, Fuller and Pearson. Using various models the limiting conversion efficiency has been calculated under different sunlight conditions and found to range between 7.8 and 22 percent, depending on the particular assumptions made.

The energy lost in the converter ceases to be available through four phenomena, namely: a relatively large number of the photons incident on an untreated semiconductor surface suffer reflection and are lost; of the photons entering the semiconductor, many are either transmitted through the material and so lost or are absorbed at some distance from the junction, creating carrier pairs which suffer recombination without contributing to the useful converter output; of the carrier pairs which are separated by the junction a portion are lost due to the forward "leakage" current through the converter; finally, the portion of the photon energy in excess of that required to produce and free hole-electron pairs does not contribute to the useful output of the device.

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