Journal of Solar Energy Engineering

Book Reviews

Selective Optical Surfaces for Solar Energy Converters, M. M. Koltun, Allerton Press, Inc., New York, 1981, 240 pages, $42.50

This book contains a large compilation of examples of optical multilayer stacks and antireflecting coatings as applied to solar energy conversion. The author undertakes a classical approach to optical modeling, consisting of the solution to Fresnel's equations for a large number of semiconductors, metal, and dielectric multilayer systems, with specific emphasis on the reduction of the reflection coefficient in the solar region of the spectrum.

The majority of the book is dedicated to photovoltaic solar energy conversion and as such examines efficiencies of A-R coated cells as a function of the number of A-R layers, selectivity of solar cells, as well as noting various other properties of cells: the effect of U.V. radiation, thermal cycling, mechanical damage and errosion, angle of incidence of solar radiation, and stability under particle irradiation pertaining to space utilization of cells. The cells discussed, however, are standard silicon or gallium arsenide systems, with no mention of amorphous semiconductors, other compound semiconductors, or new process polysilicon samples. As a result, the discussions and the references are dated.

Selectivity is ineffectively defined in terms of a high ratio of α_s/ϵ_T and is mainly discussed for the cases of A-R coating generation of selective samples. Solar thermal conversion is lightly treated with, again, emphasis on layered coatings of semiconductor films on metals. Particulate systems for solar energy absorption and effective medium approaches to defining the optical properties and selectivity for such systems are only briefly mentioned, and recent advances in particulate selective solar energy converters are made more noticeably absent with statements such as ". . .the most promising approach [in generating selective coatings] is to continue the improvements in the properties of selective multilayer interference coatings." A chapter on "Combined Converters" is included and notes several special purpose coatings linked to applications in Space which produce useful energy in several convenient forms at the same time.

The book, however, is a useful reference text for A-R coatings applicability to (mainly) solar cells. This is due to many examples and reflection coefficients expressions for a variety of A-R coating/solar cell combinations which are given in the text. It seems that although the book was originally published in 1979, some of the material and the references are quite dated. This is partially due to the recent research activity in the field of solar energy conversion (both thermal and photovoltaic) and is the major source of the book's limitations. Chapter headings on each page would have also made this a more useful reference text.

Reviewed by:

A. Ignatiev
Department of Physics,
University of Houston,
Houston, Texas 77004