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SOLID-STATE ASPECTS OF SOLAR ENERGY CONVERSION

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Economically attractive conversion of solar energy on a large scale will depend on improved solutions to a number of problems in material science. There is no gamble in solar energy with respect to technological feasibility. However, economy dictates in some aspects a search for new technologies in the face of existing and workable but overly expensive solutions.

The review identifies in the case of photothermal and photovoltaic conversion the problem areas where solid-state physics can make a contribution. The emphasis is on thin-film technology venturing the claim that thin-film technology will play a major role in future large-scale conversion. Advantages and disadvantages of the thin-film approach will be discussed for both types of conversion. The principles of material selection will be presented, and the various ways to obtain the required spectral selectivity discussed. The possibilities of tailoring materials are summarized, and the consequences of structural imperfection explained. Going through the various components of a convertor stack of either type, the review points to critical areas and outlines existing solutions to problems. Substrate, buffer layer, reflectors, electrodes, antireflection layers, and the interfaces in between them are discussed. The active layer can be prepared by a variety of methods, and their relative merits are reviewed. It is finally concluded that the existing technology of solar energy conversion can undoubtedly benefit from an increased emphasis on solid-state research.