Oxide Semiconductors for Solar Energy Conversion: Titanium Dioxide (Green Chemistry and Chemical Engineering)

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Oxide semiconductors, including titanium dioxide (TiO_2), are increasingly being considered as replacements for silicon in the development of the next generation of solar cells. **Oxide Semiconductors for Solar Energy Conversion: Titanium Dioxide** presents the basic properties of binary metal oxide semiconductors and the performance-related properties of TiO_2 as they relate to solar energy.

The book provides a general background on oxide semiconductors based on binary oxides and their solid solutions, including electronic and ionic conductors. It covers several aspects of solid-state electrochemistry of oxides, such as defect chemistry, and defect-related properties, such as electrical properties, diffusion, segregation, and reactivity. The author also takes a pioneering approach in considering bulk versus surface semiconducting properties, showing how they are different due to the effect of segregation.

One of the first on semiconducting, photocatalytic, and photoelectrochemical properties of TiO_2 and its solid solutions with donor- and acceptor-type ions, the book discusses defect chemistry of TiO_2 in terms of defect equilibria and defect-related properties, including electrical properties, self and chemical diffusion, surface properties, segregation, and reactivity and photoreactivity with oxygen, water, and microbial agents. The text also illustrates the use of TiO_2 as an emerging material for solar energy conversion systems, including the generation of hydrogen fuel by photoelectrochemical water splitting, the photocatalytic purification of water, and the generation of photovoltaic electricity. In addition, it presents defect disorder diagrams for the formation of TiO_2-based semiconductors with controlled properties.

Encompassing the areas of solid-state science, surface chemistry, and photocatalysis, this book reflects the increasing awareness of the importance of structural imperfections, such as point defects, in understanding the properties of metal oxides, specifically TiO_2-based semiconductors.

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