Upenn earth-abundant oxide photovoltaics

Working Dinner & Historical Perspective Presenters. Bob Birkmire (UDel): Cu 2 S/CdS Solar Cells: Birth of Thin Film Technologies; Jim Stevens (Dow): Progress in Advancing Earth-Abundant PV Technology from the Lab to Commercial Development; This session reviewed the birth of thin film technologies. The successes and failures of early research on Cu 2 S/CdS thin film solar ...

thode based on abundant constituents. 2. Recent Advances in Earth-Abundant Photo-cathodes 2.1. Cuprous oxide Cuprous oxide (Cu2O) is one of the most investigated abun-dant p-type semiconductors for PEC water splitting. The hy-bridization of Cu 3d-O 2pin the VB of Cu2Oyields asmaller Wooseok Yang received his BS in 2012

4 Earth-Abundant Oxides. Oxide-based materials are used in a wide variety of applications at high temperatures, such as energy generation, conversion, or storage ... sensing and solar cells, and cupric oxide or tenorite, CuO (direct bandgap around 1.2 to 1.5 eV), with is the basis for different high-temperature superconductors. The first has a ...

Zinc oxide (ZnO), an attractive functional material having fascinating properties like large band gap (~3.37 eV), large exciton binding energy (~60 meV), high transparency, high thermal, mechanical and chemical stability, easy tailoring of structural, optical and electrical properties, has drawn a lot of attention for its optoelectronic applications including energy harvesting.

identification of appropriate PV materials made from Earth-abundant elements. We have determined the elemental basis set comprising Earth-abundant materials, both from the perspective of resource ... cuprous oxide", Journal of Applied Physics, 46 (1), 1975, pp. 163-172. [5] S. Ishizuka et al., "Nitrogen doping into Cu

Among the emerging thin-film photovoltaic (PV) materials formed by earth-abundant and nontoxic elements, the so-called kesterite (Cu 2 ZnSn(S,Se) 4 --CZTSSe; Cu 2 ZnSnS 4 --CZTS; Cu 2 ZnSnSe 4 --CZTSe) has become in the last years the most relevant and promising technology. Similar in many aspects to the most mature chalcopyrite (Cu(In,Ga)Se 2 --CIGS), ...

In this chapter, we have presented a novel fabrication process for the creation of oxide based core-shell nanowire photovoltaic cells. The major focus of this design process has been to keep costs low. To do this, earth-abundant materials have been investigated as well as wet chemical fabrication methods.

Structure and Electronic Properties of Grain Boundaries in Earth Abundant Photovoltaic Absorber CZTS ACS NANO 5(11) 8613 - 8619 OCTOBER 2011. F. Guo, F .Kim, T. H. Han,V .B. Shenoy,J. Huang and R. Hurt Hydration-Responsive Folding and Unfolding in Graphene Oxide Liquid Crystal Phases ACS NANO 5(10)

8019-8025 AUGUST 2011. P. Johari ...

In 2009, Yuhas and Yang 35 proposed application of ZnO single-crystalline nanowires as electron transporters in all-oxide solar cells. The p-type oxide was Cu 2 O, in form of a nanoparticle film, with thickness around 800 nm, fully burying the ZnO nanowires (Figure 14). The full cell was fabricated using solution-based techniques, aiming at ...

Earth-abundant transition metals (Fe, Co, Ni, Cu, Mn, etc.) and their oxides based nanomaterials display exceptional characteristics, including (i) mimicking the metal surface activation and catalysis [21], [22], [23], (ii) as support materials for a variety of noble metal nanoparticles (Au, Ag, Pt, Pd, and their bi-, and tri-metallic nanomaterials) [24], [25], [26], (iii) ...

The characteristic solar cell is known with the following parameters: 5.3.1 Short-Circuit Current (I sc). The short-circuit current, I sc, is one of the major characteristic of a solar cell, and the value is taken when a solar cell is short circuited [].The short-circuit current is the current obtained when there is no load in the connection or when there are zero loads.

1. Introduction. In a brief span, inorganic-organic perovskite solar cells (PSCs) exercising a single absorber layer have demonstrated an exceptional power conversion efficiency (PCE) of 26.08% in contrast to other photovoltaic (PV) devices [1].However, hazardous lead and material instabilities caused by humidity and radiation limit their commercialization [2], [3].

Iron disulfide (FeS 2) (also known as fool"s gold) is an earth abundant material makes it supreme material for PV applications. FeS 2 exists in mainly two phases such as marcasite and pyrite. Nontoxic, earth abundant, high absorption coefficient of pyrite offers its suitability as unique absorber material . The high absorption coefficient ...

Tremendous success has been achieved in photovoltaic (PV) applications, but PV-generated electricity still cannot compete with traditional power in terms of price. Chemically stable and nontoxic all-oxide solar cells made from earth-abundant resources fulfill the requirements for low-cost manufactur ...

Zinc oxide (ZnO) is an earth abundant wide bandgap semiconductor of great interest in the recent years. ZnO has many unique properties, such as non-toxic, large direct bandgap, high exciton binding energy, high transparency in visible and infrared spectrum, large Seebeck coefficient, high thermal stability, high electron diffusivity, high electron mobility, and ...

(DOI: 10.1039/D0EE02397C) Photoelectrochemical (PEC) solar-fuel conversion is a promising approach to converting energy from sunlight into storable chemical fuels. The development of low cost, highly efficient, and stable semiconductor-based photoelectrodes is a key step in realizing economically viable PEC energy conversion on a global scale. The p-type ...

In this work, we introduce a double CZTS-layered design with a high-performance Electron Transport Layer (ETL) as an effective way to increase the efficiency of Kesterite solar cells. Our modeling methodology comprehensively considers various loss mechanisms, such as radiative recombination, defect and trap densities within the bulk CZTS, and the ETL/CZTS ...

Amorphous SnO 2 as Earth-abundant Stable Transparent Conductive Oxide and Its Application to Si Heterojunction Solar Cells. Takashi Koida, Corresponding Author. Takashi Koida ... and short circuit current density compared to ...

Efficiency and stability enhancement of perovskite solar cells using reduced graphene oxide derived from earth-abundant natural graphite ... energy source. At present, the PV market is mainly dominated by crystalline silicon solar cells. This class of solar cells is a mature technology and can efficiently convert the sun"s energy into ...

This discovery has reinvigorated efforts within the Earth-abundant PV community to design efficient solar absorbers, drawing inspiration from the halide perovskites, with particular focus on defect tolerance and achieving materials with long diffusion lengths. At the same time, the broad families of Earth-abundant solar absorbers provide ...

Water photolysis at 12.3% efficiency via perovskite photovoltaics and Earth-abundant catalysts. Jingshan Luo, Jeong-Hyeok Im, ... Siu M. K., Trudel S., Berlinguette C. P., Photochemical route for accessing amorphous metal oxide materials for water oxidation catalysis. Science 340, 60-63 (2013). Crossref. PubMed. Web of Science. Google Scholar ...

Efficiency and stability enhancement of perovskite solar cells using reduced graphene oxide derived from earth-abundant natural graphite+ Selengesuren Suragtkhuu,a Odonchimeg Tserendavag,a Ulziibayar Vandandoo,bc Abdulaziz S. R. Bati, d Munkhjargal Bat-Erdene,d Joseph G. Shapter, *d Munkhbayar Batmunkh *de and Sarangerel Davaasambuu*a Graphene ...

On the other hand, Cu 2 O is a native p-type metal oxide semiconductor with a direct band gap ~2.1 eV and high absorption coefficient (10 4 -10 5 cm -1) [19].The theoretical power conversion efficiency according to the Shockley-Queisser model for Cu 2O-based solar cells is ~20% [20].Since the year 2000, there has been a growing interest in Cu 2 O with ...

Evolution of the zT obtained for different materials for different temperatures in recent years (from 2002 to today, 2021), based on the data analyzed in this article. The different materials are sulfides (red), tetrahedrites (yellow), earth ...

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