

Ternary Rare Earth Sulfide CaCe_2S_4 : Synthesis and Characterization of Stability, Structure, and Photoelectrochemical Properties in Aqueous Media

Paola Sotelo, Melissa Orr, Miguel Tayar Galante, Mohammad Kabir Hossain, Farinaz Firouzan, Abbas Vali, Jun Li, Mas Subramanian, Claudia Longo, Krishnan Rajeshwar, Robin T. Macaluso



PII: S0022-4596(18)30068-9
DOI: <https://doi.org/10.1016/j.jssc.2018.02.014>
Reference: YJSSC20118

To appear in: *Journal of Solid State Chemistry*

Received date: 15 November 2017
Revised date: 14 February 2018
Accepted date: 16 February 2018

Cite this article as: Paola Sotelo, Melissa Orr, Miguel Tayar Galante, Mohammad Kabir Hossain, Farinaz Firouzan, Abbas Vali, Jun Li, Mas Subramanian, Claudia Longo, Krishnan Rajeshwar and Robin T. Macaluso, Ternary Rare Earth Sulfide CaCe_2S_4 : Synthesis and Characterization of Stability, Structure, and Photoelectrochemical Properties in Aqueous Media, *Journal of Solid State Chemistry*, <https://doi.org/10.1016/j.jssc.2018.02.014>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Ternary Rare Earth Sulfide CaCe_2S_4 : Synthesis and Characterization of Stability, Structure, and Photoelectrochemical Properties in Aqueous Media

Paola Sotelo^a, Melissa Orr^a, Miguel Tayar Galante^{a,c}, Mohammad Kabir Hossain^a, Farinaz Firouzan^a, Abbas Vali^a, Jun Li^b, Mas Subramanian^b, Claudia Longo^c, Krishnan Rajeshwar^a, Robin T. Macaluso^{a*}

^aDepartment of Chemistry and Biochemistry, The University of Texas at Arlington, Arlington, TX 76019

^bDepartment of Chemistry, Oregon State University, Corvallis, OR 97331

^cInstitute of Chemistry, University of Campinas–UNICAMP, 13083-970, Campinas, Brazil

* Corresponding author: robin.macaluso@uta.edu

Abstract

A red-orange rare earth ternary chalcogenide, CaCe_2S_4 , was prepared in powder form by solid-state synthesis. The structural details of this compound were determined by powder X-ray diffraction. The optical band gap of CaCe_2S_4 was determined by diffuse reflectance spectroscopy (DRS) to be ~ 2.1 eV, consistent with the observed red-orange color. Quantitative colorimetry measurements also support the observed color and band gap of CaCe_2S_4 . Both direct and indirect optical transitions were gleaned from Tauc analyses of the DRS data. Photoelectrochemistry experiments on CaCe_2S_4 films showed *n*-type semiconductor behavior. Analyses of these data via the Butler-Gärtner model afforded a flat-band potential of -0.33 V (vs. Ag/AgCl/KCl 4 M) in $\sim \text{pH } 9$ aqueous sulfite electrolyte. The potential and limitations of this material for solar water splitting and photocatalytic environmental remediation (e.g., dye photodegradation) are finally presented against the backdrop of its photoelectrochemical stability and surface hole transfer kinetics in aqueous electrolytes.

Graphical abstract

Download English Version:

<https://daneshyari.com/en/article/7757771>

Download Persian Version:

<https://daneshyari.com/article/7757771>

[Daneshyari.com](https://daneshyari.com)