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 b. Nomor ISSN : 2053-1591
 c. Volume, Nomor, Bulan, Tahun : Vol. 4 , No. 7, Juli 2017
 d. Penerbit : IOP Publishing
 e. DOI artikel (jika ada) :
 f. Alamat web jurnal : <https://iopscience.iop.org/article/10.1088/2053-1591/aa7310>
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Prof. Dr. Kusworo Adi, S.Si., M.T.
 NIP. 197203171998021001
 Bidang ilmu/Unit kerja : Fisika/Fakultas Sains dan Matematika

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Reviewer 1

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NIP. 195806151985031002

Unit Kerja : Fisika

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Photocatalytic activity of cobalt-doped zinc oxide thin film prepared using the spray coating technique

Sutanto, Heri^a  ; Wibowo, Singgih^a; Hadiyanto^b; Arifin, Mohammad^a; **Hidayanto, Eko^a** Save all to author list^a Faculty of Science and Mathematics, Department of Physics, Smart Materials Research Center (SMARC), Diponegoro University, Tembalang, Semarang, Indonesia^b Department of Chemical Engineering, Faculty of Engineering, Diponegoro University, Tembalang, Semarang, Indonesia11 57th percentile
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We report on the synthesis, characterization and photocatalytic activity of ZnO: Co thin films coated onto amorphous glass substrates by sol-gel spray coating technique. Structural and optical properties of the films were evaluated using x-ray diffractometer (XRD) and uv-vis spectrophotometer (UV-Vis), respectively. XRD patterns showed that the samples exhibited hexagonal wurtzite structure. The addition of cobalt reduced the (0 0 2) peak. This doping also reduces transparency and optical band gap. The band gap (E_g) markedly decreased from 3.20 eV to 3.00 eV for undoped ZnO and ZnO: Co with 10 mol% of doping concentration, respectively. Our thin films exhibited good structural, optical and photo catalytic properties. In this study, ZnO with 4 mol% of Co was observed to have the highest

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TOPICAL REVIEW

N-type solar cells: advantages, issues, and current scenarios

RECEIVED
8 November 2016

REVISED
17 February 2017

ACCEPTED FOR PUBLICATION
27 February 2017

PUBLISHED
5 July 2017

Bandana Singha and Chetan S Solanki

Department of Energy Science and Engineering, Indian Institute of Technology Bombay, Mumbai 400076, India

E-mail: bandana@iitb.ac.in

Keywords: n-type Si wafers, boron diffusion, technological issues, market coverage

Abstract

Crystalline silicon, including p-type czochralski (CZ) mono-crystalline and multi-crystalline (mc) silicon, has been the workhorse for solar cell production for decades. In recent years, there has been many developments in n-type c-Si solar cells basically due to the advantages of n-type c-Si wafers over p-type wafers. However, there are some limitations in making n-type solar cells considering the technologies involved to fabricate p-type cells. In this paper, different advantages of n-types wafers, their limitations in solar cell production, and an analysis of total market coverage are discussed.

1. Introduction

Crystalline Si, comprising p-type czochralski (CZ) mono-crystalline Si and multi-crystalline (mc) Si, has been the mainstay in solar cell production. The first crystalline Si solar cell was made on n-type substrates in the 1950s [1] but the p-type technology has become more dominant in the current solar cell market. During 1970s when the only application of solar cells was for space vehicles, the solar cell industry changed to p-type substrates due to their higher resistance to space radiation. The use of p-type substrates for terrestrial cells continues to the present era, although there are other available options. Another reason for their use is the higher mobility of electrons, which are the minority carrier in p-type Si, resulting in higher diffusion lengths [2]. However, boron doped (B-doped) CZ-Si based solar cells have shown a reduced cell performance due to light-induced degradation (LID) even after storage in the dark. There are other difficulties that arise because p-type Si is less resistant to certain metallic impurities [2]. There also exists a similar quantity of n-type and p-type Si scrap from the semiconductor industry, and using n-type Si for solar cell production would attenuate the shortage of p-type Si. Therefore, scientists and researchers are more concerned about new techniques that could be used for n-type solar cells because of their availability and advantages [3]. In this paper, we will discuss in detail the advantages of n-type wafers, feasibility issues, and the current market scenario.

2. Advantages of n-type Si

When a single type of wafer is considered, the phosphorus doped (P-doped) n-type Si has various advantages over B-doped Si substrates, which reflects the probability of its extensive use toward technology development for very thin wafers and high cell efficiency [4]. The major advantages are explained below.


2.1. Avoidance of B–O degradation

O is intentionally added during the fabrication of CZ wafers because it improves wafer strength [5]. The CZ-Si obtains O during ingot growth by dissolution of O from the quartz crucible containing the Si melt [6–8]. The CZ-Si has around three times higher concentrations of dissolved O compared to mc-Si [9]. This O forms a recombination active centre in the presence of light or under illumination for B-doped p-type Si [10]. This kind of defect causes a decrease in the efficiency of p-type solar cells made from CZ-Si [11]. These meta-stable defects near the mid energy band result in some final defect levels near the conduction band (at $E_c - 0.026$ eV), and module output drops by about 3% in the first few hours of light exposure [12]. This defect can be avoided by removing either the B or the O. The use of magnetically confined B-doped CZ-Si where the O content is lower can be a solution, but potentially expensive. Replacing the B dopant with other p-type dopants via Ga or In induces large variations in the resistivity of the ingots [13]. Thus, it can be seen that P-doped n-type Si wafers are the realistic solution to the problem, and

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Occurrence of photoluminescence and onion like structures decorating graphene oxide with europium using sodium dodecyl sulfate surfactant

V J Cedeño¹, R Rangel² , J L Cervantes¹, J Lara², J J Alvarado³ and D H Galván⁴

Published 10 July 2017 • © 2017 IOP Publishing Ltd

Materials Research Express, Volume 4, Number 7

Citation V J Cedeño *et al* 2017 *Mater. Res. Express* **4** 075006

rrangel@umich.mx

¹ Programa de Doctorado en Ingeniería Química, División de Estudios de Posgrado, Facultad de Ingeniería Química, Universidad Michoacana de San Nicolás de Hidalgo, Z.C. 58060, Morelia, Michoacán, **Mexico**

² División de Estudios de Posgrado, Facultad de Ingeniería Química, Universidad Michoacana de San Nicolás de Hidalgo, Z.C. 58060 Morelia, Michoacán, Mexico

³ CINVESTAV-IPN, Unidad Mérida, Mérida, Yuc, Mexico

⁴ CNYN-UNAM, Ensenada, B.C., Mexico

R Rangel  <https://orcid.org/0000-0002-4952-9939>

Received 11 May 2017

Accepted 5 June 2017

Published 10 July 2017

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Revisions: 1

Screened for originality? Yes

<https://doi.org/10.1088/2053-1591/aa76f9>

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