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HASIL PENILAIAN SEJAWAT SEBIDANG ATAU *PEER REVIEW*
KARYA ILMIAH : JURNAL ILMIAH

Judul Karya Ilmiah (Artikel)	:	Photocatalytic activity of cobalt-doped zinc oxide thin film prepared using the spray coating technique
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Status Pengusul	:	~~Penulis pertama~~/ Penulis ke-5/ ~~Penulis Korespondesi~~ **
Identitas Jurnal Ilmiah	:	a. Nama Jurnal : Materials Research Express
		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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Semarang, 26 Mei 2022

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Semarang, 26 Mei 2022
Reviewer 1

Prof. Dr. Drs. Wahyu Setia Budi, M. S.
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Photocatalytic activity of cobalt-doped zinc oxide thin film prepared using the spray coating technique

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Abstract

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 (Eg) 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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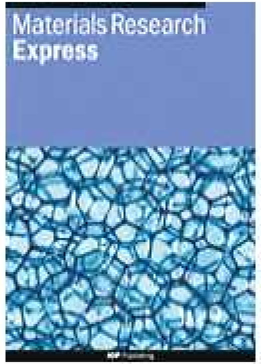

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Dr Yi Cao received his bachelor's degree in 2001 and Master's degree (Supervisor: Prof. Xiqun Jiang) in 2004 from Nanjing University. He then obtained his PhD in 2009 from the University of British Columbia (Supervisor: Prof. Hongbin Li). After a one-year postdoc at the same place, he started his independent career at the Department of Physics, Nanjing University as a full professor in 2010. His work was recognized by several awards including the 2014 IUPAP Young Scientist Prize in Biological Physics, the 2018 Young Innovator Award in Nanobiotechnology by Nano Research, and the 2019 Young Scientist Award from the Biomedical Polymer Materials Division of the Chinese Society for Biomaterials.

Judy Wu, University of Kansas, USA

Dr Judy Wu is a Distinguished Professor of Physics at the University of Kansas. She received her PhD from the University of Houston. She is an experimental condensed matter physicist and is specialized in fabrication, characterization and device applications of thin films and nanostructures. Her current research focuses on understanding the interfaces in ultrathin metal-insulator-metal tunnel junctions including Josephson tunnel junctions, magnetic tunnel junctions, memristors for quantum and neuromorphic computing, and in graphene-based heterostructures nanohybrids quantum sensors including photodetectors, strain/bio/gas/chemical sensors.

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TOPICAL REVIEW

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

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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

PAPER

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

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