# Journa

# of Achievements in Materials and Manufacturing Engineering

Published monthly as the organ of the World Academy of Materials and Manufacturing Engineering

Editor-in-Chief Prof. Leszek A. Dobrzański

Volume 53 • Issue 1 • July 2012

ISSN 1734-8412



http://www.journalamme.org



of Achievements in Materials and Manufacturing Engineering PUBLISHED SINCE 1992 formerly as Proceedings on Achievements in Mechanical and Materials Engineering

# Published monthly as the organ of the World Academy of Materials and Manufacturing Engineering

# Editor-in-Chief

Prof. Leszek A. Dobrzański - Gliwice, Poland

#### **Editorial Council**

## Deputies Editor-in-Chief

South America Prof. Maria Helena Robert - Campinas, Brazil North America Prof. George Totten - Portland, USA Europe Prof. Jose Manuel Torralba - Madrid, Spain Asia Prof. Yong Taek Im - Daejeon, South Korea Australia Prof. Kanaka Durga Vara Prasad Yarlagadda - Brisbane, Australia Africa Prof. Abdalla Wifi - Cairo, Egypt

## **Associate Editors Team**

Production Editor Ms Marzena Kraszewska, MA Team Secretary Dr Małgorzata Dziekońska Thematic Area Editors Dr Mirosław Bonek Dr Klaudiusz Gołombek Dr Magdalena Polok-Rubiniec Dr Anna Włodarczyk-Fligier Dr Bogusław Ziębowicz Statistical Editor Dr Daniel Pakuła

#### Language Editor Dr Janusz Madeiski

#### **Editorial Assistance**

Ms Justyna Hajduczek, MSc Mr Paweł Jarka, MSc Ms Magdalena Kałużna, MSc Ms Małgorzata Ondrula, MSc

# **Reading Direct**

Mr Adam Jagiełło, MSc Mr Piotr Zarychta, MSc



This journal is a part of Reading Direct, the free of charge alerting service which sends tables of contents by e-mail for this journal and in the promotion period also the full texts of papers. You can register to Reading Direct at http://www.journalamme.org

#### **Editorial Key Reviewers Committee**

Prof. Sadek Absi Alfaro - Brasilia, Brazil Prof. Gilmar Batalha - Sao Paulo, Brazil Prof. Emin Bayraktar - St-Ouen, France Prof. Andrzej Buchacz - Gliwice, Poland Prof. Tara Chandra - Wollongong, Australia Prof. Antonio Cuhna - Guimaraes, Portugal Prof. Marek Dollar - Oxford, Ohio, USA Prof. Georgiy Drapak - Khmelnitsky, Ukraine Prof. Sabahudin Ekinović - Zenica, Bosnia and Herzegovina Prof. Renato Esposito - Naples, Italy Prof. Spilios Fassois - Patras, Greece Prof. Janez Grum - Ljubljana, Slovenia Prof. Toshio Haga - Osaka, Japan Prof. Abdel Magid Hamouda - Doha, Qatar Prof. Stuart Hampshire - Limerick, Ireland Prof. Marek Hetmańczyk - Katowice, Poland Prof. Hong Hocheng - Hsinchu, Taiwan Prof. Werner Hufenbach - Dresden, Germany Prof. Mark James Jackson - Worcester, USA Prof. Jerzy Jędrzejewski - Wroclaw, Poland Prof. Rudolf Kawalla - Freiberg, Germany Prof. Andrzej Klimpel - Gliwice, Poland Prof. Ivars Knets - Riga, Latvia Prof. Janez Kopač - Ljubljana, Slovenia Prof. Piotr Kula - Lodz, Poland Prof. Karl Kuzman - Ljubljana, Slovenia Prof. Bogusław Major - Cracow, Poland Prof. Cemal Meran - Denizli, Turkey Prof. Stanisław Mitura - Lodz, Poland Prof. Andrew Nee - Singapore, Singapore Prof. Jerzy Nowacki - Szczecin, Poland Prof. Abraham Ogwu - Paisley, United Kingdom Prof. Jerzy Pacyna - Cracow, Poland Prof. Peter Palček - Zilina, Slovak Republic Prof. Fusheng Pan - Chongqing, China Prof. Zbigniew Rdzawski - Gliwice, Poland Prof. Mario Rosso - Turin, Italy Prof. Stanislav Rusz - Ostrava, Czech Republic Prof. Yuriy Shalapko - Khmelnitsky, Ukraine Prof. Božo Smoljan - Rijeka, Croatia Prof. Jerry Sokolowski - Windsor, Ontario, Canada Prof. Mirko Soković - Ljubljana, Slovenia Prof. Zinoviy Stotsko - Lviv, Ukraine Prof. Jerzy Świder - Gliwice, Poland Prof. Ming-Jen Tan - Singapore, Singapore Prof. Miklos Tisza - Miskolc, Hungary Prof. Boris Tomov - Rousse, Bulgaria Prof. Gabriel Wróbel - Gliwice, Poland Prof. Bekir Sam Yilbas - Dhahran, Saudi Arabia Prof. Marian Żenkiewicz - Bydgoszcz, Poland



#### Patronage



World Academy of Materials and Manufacturing Engineering



Polish Academy of Sciences, Committee of Materials Science, Section of Metallic Materials



International Federation of Heat Treatment and Surface Engineering



Association of Computational Materials Science and Surface Engineering

Institute of Engineering Materials and Biomaterials of Silesian University of Technology, Gliwice, Poland

# Financial support

The efforts to achieve the financial support of the Journal in 2012 from the Ministry of Science and Higher Education in Poland have begun.

#### Abstracting services

This Journal is sent to individual receivers from ca. 50 countries of the world and is delivered to the National Libraries and Universities and also to other scientific institutions in ca. 50 countries of the world. The electronic system of Reading Direct allows to access to the electronic version of that journal online, in the promotional period free of charge. This Journal is included in the reference list of the Polish Ministry of Science and Higher Education (9 points). The Journal is cited by Abstracting Services such as:



The procedure of its registration in the databases of Scopus, Compandex, CiteSeer, GetCited, Web of science, Engineering Village, Public Knowledge Project, Edith Cowan University's Institutional Repository, Journals Online and Inspec has begun.

#### **Journal Registration**

The Journal is registered by the Civil Department of the District Court in Gliwice, Poland at number 279.

#### Publisher



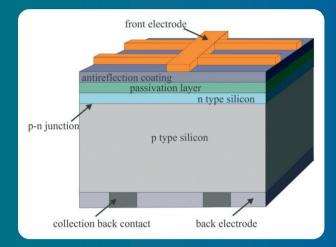
Gliwice 44-100, Poland ul. S. Konarskiego 18a/366 e-mail: info@journalamme.org

Stowarzyszenie Komputerowej Nauki o Materiałach i Inżynierii Powierzchni Bank name: ING Bank Śląski

Bank address: ul. Zwycięstwa 28, 44-100 Gliwice, Poland Account number/ IBAN CODE: PL76105012981000002300809767 Swift code: INGBPLPW

Gliwice – Campinas – Portland – Madrid – Daejeon – Brisbane – Cairo \* 2012 International OCSCO World Press. All rights reserved

0 The paper used for this Journal meets the requirements of acid-free paper Printed in Poland



7

The paper entitled "Monocrystalline silicon solar cells applied in photovoltaic system" by L.A. Dobrzański, A. Drygała, M. Giedroć and M. Macek on a **page 7** 

demonstrates the production of the monocrystalline silicon solar cells using the conventional technology by means of screen printing process and using them to create the photovoltaic system. The investigation of current - voltage characteristic to determinate basic electrical properties of monocrystalline silicon solar cells were investigated under Standard Test Condition. Photovoltaic module was produced from solar cells with the largest short-circuit current, which were joined in series. The module was used to build a demonstration photovoltaic system traffic light – pedestrian crossing, which shows the practical use of widely available, renewable energy source which is the Sun. The key to solve ecological problems, which are effects of mass combustion of fossil fuel such as: coal and crude oil is the development of renewable energy technology such as photovoltaic energy. This work presents a conventional technological process by means of the screen printed method of monocrystalline silicon solar cells production. In order to obtain a device producing an electrical energy, solar cells were connected in a photovoltaic module, then protected from damages by Schottky and Zener diodes.