

# Journal

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 51 • Issue 2 • April 2012







# Journal

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 Gómbek

Dr Magdalena Polok-Rubinić

Dr Anna Włodarczyk-Fligier

Dr Bogusław Ziębowicz

### Statistical Editor

Dr Daniel Pakuła

### Language Editor

Dr Janusz Madejski

## 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

## 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 - Khmel'nitsky, 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 - Wrocław, Poland

Prof. Rudolf Kawalla - Freiberg, Germany

Prof. Andrzej Klimpel - Gliwice, Poland

Prof. Ivars Knetis - 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 Ruz - Ostrava, Czech Republic

Prof. Yuriy Shalapko - Khmel'nitsky, 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



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>

## 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:



Directory of Open  
Access Journals



Google Scholar



Scirus



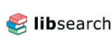
Ulrich's  
Periodical Directory



BazTech



Journalseeker



Libsearch



WorldCat



Dragon  
Libraries  
Catalogue

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

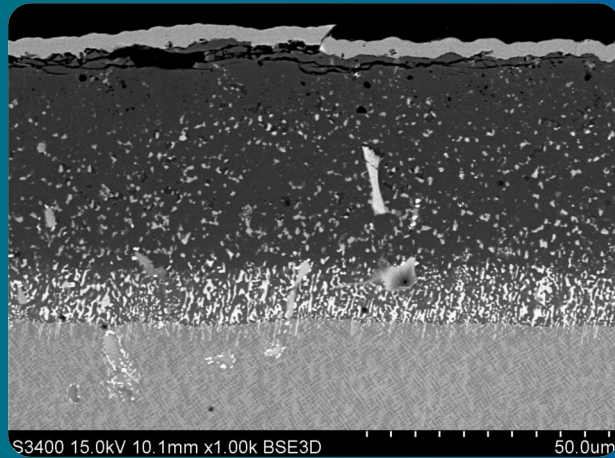


Gliwice 44-100, Poland  
ul. S. Konarskiego 18a/366  
e-mail: info@journalamme.org

Bank account:  
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  
∞ The paper used for this Journal meets the requirements of acid-free paper  
Printed in Poland

## Selected materialographical photo



67

Authors: M. Pytel, M. Góral, M. Motyka and T. Miziniak in the paper entitled "Thermal stability of protective coatings produced on nickel based superalloy" on a **page 67** presents the results of high temperature cyclic oxidation tests of the protective diffusion coatings. One of the main purposes of this work was to produce three different types of protective coatings by three different methods, i.e. slurry method, vapour phase aluminizing (VPA) and chemical vapour deposition (CVD), applied on nickel based René 80 superalloy substrate. The research of the hot-corrosion resistance demonstrated the high-temperature method of cyclic oxidation on the surface of superalloy René 80 causes deficiency in protective coating the maximal increase in mass associated with the formation of products of oxidation and the shortest time of achieving the initial value of mass of the sample – the fundamental criterion of the oxidation resistance. The maximal increase of the mass of samples with obtained coating was being observed in case of the CVD method, and the smallest ones after the application of the "slurry" method. The largest number of oxidation cycles to achieve the initial mass was for the stated CVD coatings, less for the VPA coatings (estimated value) and the least for the "slurry" coatings. It was found out that higher growth in the oxidation process is directly correlated with great resistance to the effect of this phenomenon, how it is possible to foresee results from "purity" of additive CVD  $\beta$  – NiAl layer as well as the easiness of the formation of the tight and protective of thin  $Al_2O_3$  layer (large number of cycles). The aluminide coating obtained by CVD method demonstrated the greatest oxidation resistance, the thinnest ones from received ones. In this case it is possible to suppose that good oxidation resistance results from the coating structure and its purity than its thickness.