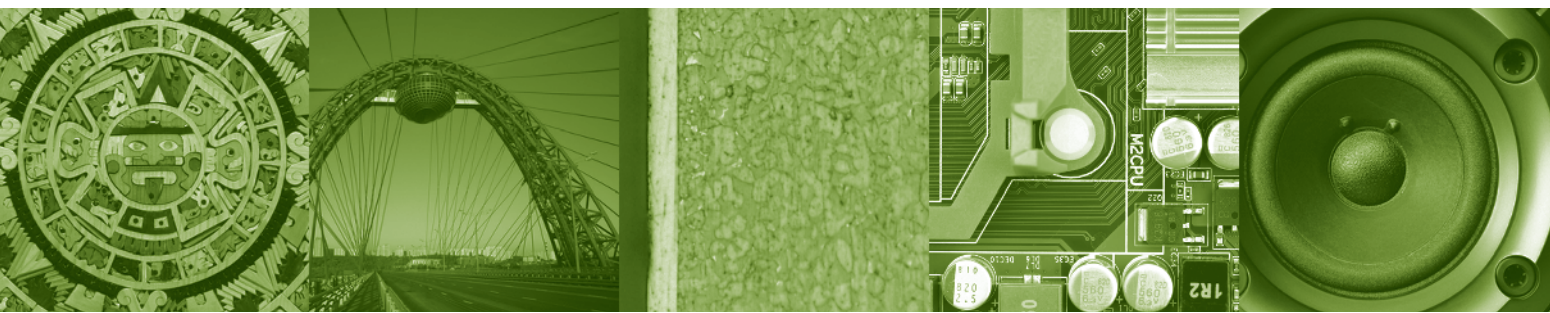




Volume 64
Issue 1
November 2013
Pages 1-48

Published since 1978
formerly as Archives of Materials Science
or Archiwum Nauki o Materiałach (in Polish)

Archives of Materials Science and Engineering



Editor-in-Chief Prof. Leszek A. Dobrzański

International Scientific Journal published monthly
by the World Academy of Materials
and Manufacturing Engineering

<http://www.archivesmse.org>



PUBLISHED SINCE 1978 – formerly as Archives of Materials Science or Archiwum Nauki o Materiałach (in Polish)

Editor-in-Chief

Prof. Leszek A. Dobrzański – Gliwice, POLAND

Editorial Council

DEPUTIES EDITOR-IN-CHIEF

Prof. Gilmar Batalha – Sao Paulo, BRASIL
Prof. Nikolaos Gouskos – Athens, GREECE
Prof. Toshio Haga – Osaka, JAPAN
Prof. Abdel Magid Hamouda – Doha, QATAR
Prof. Mark J. Jackson – Worcester, USA
Prof. Thomas Neitzert – Auckland, NEW ZELAND
Prof. Jerzy Nowacki – Szczecin, POLAND
Prof. Ming-Jen Tan – Singapore, SINGAPORE

Associated Editors Team

PRODUCTION EDITOR

Ms Marzena Kraszewska, MA – Gliwice, POLAND

TEAM SECRETARY

Dr Małgorzata Dziekońska – Gliwice, POLAND
Dr Jarosław Mięka – Gliwice, POLAND

THEMATIC AREA EDITORS

Dr Mirosław Boniek – Gliwice, POLAND
Dr Klaudiusz Gołombek – Gliwice, POLAND
Dr Krzysztof Łukaszewicz – Gliwice, POLAND
Dr Bogusław Ziębowicz – Gliwice, POLAND

STATISTICAL EDITOR

Dr Daniel Pakula – Gliwice, POLAND

LANGUAGE EDITOR

Dr Janusz Madejski – Gliwice, POLAND

Editorial Assistance

Dr Ludwina Żukowska – Gliwice, POLAND
Ms Magdalena Kujawa, MSc – Gliwice, POLAND
Ms Magdalena Macek, MSc – Gliwice, POLAND
Ms Barbara Nieradka, MSc – Gliwice, POLAND
Ms Magdalena Szczęśna, MSc – Gliwice, POLAND

Reading Direct Editors

Dr Marek Sroka, MSc – Gliwice, POLAND
Mr Adam Jagiełło, MSc – Gliwice, POLAND

Editorial Key Reviewers Committee

Prof. Dorel Banabic – Cluj Napoca, ROMANIA
Prof. Tadeusz Bold – Gliwice, POLAND
Prof. Tara Chandra – Wollongong, AUSTRALIA
Prof. Antonio Cunha – Guimarães, PORTUGAL
Prof. Jan Cwajna – Katowice, POLAND
Prof. Edward D. Doyle – Swinburne, AUSTRALIA
Prof. Georgiy Drapak – Khmelnytsky, UKRAINE

Prof. Jan Dutkiewicz – Cracow, POLAND
Prof. Stuart Hampshire – Limerick, IRELAND
Prof. Adam Hernas – Katowice, POLAND
Prof. Marek Hetmańczyk – Katowice, POLAND
Prof. Hong Hocheng – Hsinchu, TAIWAN
Prof. Werner Hufenbach – Dresden, GERMANY
Prof. David Hui – New Orleans, USA
Prof. Yong-Taek Im – Daejeon, KOREA
Prof. Leopold Jeziorski Dr hc – Czestochowa, POLAND
Prof. Jan Kazior – Cracow, POLAND
Prof. Albert Kneissl – Leoben, AUSTRIA
Prof. Ivars Knets – Riga, LATVIA
Prof. Janez Kopač Dr hc – Ljubljana, SLOVENIA
Prof. Piotr Kula – Lodz, POLAND
Prof. Krzysztof J. Kurzydłowski Dr hc – Warsaw, POLAND
Prof. Karl Kuzman – Ljubljana, SLOVENIA
Prof. Eugeniusz Łągiewka – Katowice, POLAND
Prof. Bogusław Major – Cracow, POLAND
Prof. Cemal Meran – Denizli, TURKEY
Prof. Stanisław Mitura Dr hc – Koszalin, POLAND
Prof. Ryszard Nowosielski – Gliwice, POLAND
Prof. Abraham Atta Ogwu – Paisley, UK
Prof. Jerzy Pacyna – Cracow, POLAND
Prof. Lucjan Pająk – Katowice, POLAND
Prof. Peter Palček – Zilina, SLOVAK REPUBLIC
Prof. Fusheng Pan – Chongqing, CHINA
Prof. Jan Pilarczyk – Gliwice, POLAND
Prof. Wojciech Przetakiewicz – Warsaw, POLAND
Prof. Maria Richert – Cracow, POLAND
Prof. Maria H. Robert – Campinas, BRAZIL
Prof. Mario Rosso – Turin, ITALY
Prof. Stanislav Rusz – Ostrava, CZECH REPUBLIC
Prof. Yuriy Shalapko – Khmelnytsky, UKRAINE
Prof. Jan Sieniawski – Rzeszow, POLAND
Prof. Paul Siffert – Strassburg, FRANCE
Prof. Jorge A. Sikora – Mar del Plata, ARGENTINA
Prof. Božo Smoljan – Rijeka, CROATIA
Prof. Jerry Sokolowski – Windsor, CANADA
Prof. Mirko Soković – Ljubljana, SLOVENIA
Prof. Antonio Sousa – Fredericton, CANADA
Prof. Jerzy Stobrawa – Gliwice, POLAND
Prof. Vasco Teixeira – Braga, PORTUGAL
Prof. Miklos Tisza – Miskolc, HUNGARY
Prof. Jose M. Torralba Dr hc – Madrid, SPAIN
Prof. Laszlo Toth – Miskolc, HUNGARY
Prof. Algirdas V. Valiulis – Vilnius, LITHUANIA
Prof. Tadeusz Wierzczoń – Warsaw, POLAND
Prof. Abdalla Wifi – Cairo, EGYPT
Prof. Władysław K. Włosiński Dr hc – Warsaw, POLAND
Prof. Gwomei Wu – Taoyuan, TAIWAN
Prof. Senay Yalcin – Istanbul, TURKEY
Prof. Bekir Sam Yilbas – Dhahran, SAUDI ARABIA
Prof. Andrzej Zieliński – Gdansk, POLAND
Prof. Paweł Zięba – Cracow, POLAND
Prof. Jozef Zrnik – Plzen, CZECH REPUBLIC
Prof. Marian Żenkiewicz – Bydgoszcz, POLAND
Prof. Marcel Žitňanský – Bratislava, SLOVAK REPUBLIC

Patronage



World Academy of Materials
and Manufacturing Engineering



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



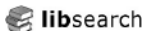
Association of Computational Materials Science
and Surface Engineering

Financial support

In 2013 the publication of the Journal is financially supported by the Ministry of Science and Higher Education in Poland.

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 on-line, 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 Compendex, 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 1st Civil Department of the District Court in Gliwice, Poland at number 278.

Publisher



INTERNATIONAL
OCSCO
WORLD PRESS

International OCSCO World Press
ul. Jagiellońska 21
44-100 Gliwice, Poland

e-mail: info@archivesmse.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: PL7610501298100002300809767

Swift code: INGBPLPW

Gliwice – Sao Paulo – Athens – Osaka – Doha – Worcester – Auckland – Szczecin – Singapore

© 2013 International OCSCO World Press.

All rights reserved.

Reading Direct

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.archivesmse.org>

© The paper used for this journal meets the requirements of acid-free paper.

Printed in Poland.

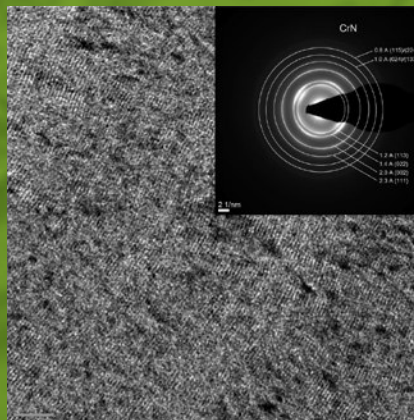
Professor

Leszek A. Dobrzanski M Dr hc
Editor-in-Chief of the AMSE
President of the WAMME
President of the ACMSE



Dear Readers,

We remind that on 2nd September 2013 the Authorities of the Association of Computational Materials Science and Surface Engineering decided that the cooperation with the Silesian University of Technology in Gliwice, Poland was over. The events of the consecutive weeks confirmed that it was the right decision. We are convinced that it opens the possibility of cooperation with many other scientific institutions in the world. It was decided that such a cooperation could be connected with one single volume or even issue in the future. Then the logo of the institution will be placed in an issue as a supporting subject of an issue. Of course it is possible that it will last longer. We expect offers of interested institutions. As usual we hand over a few next scientific papers and wish a nice reading.



The paper entitled "Structure and properties of CrN/DLC coating deposited by PVD ARC-cathodes and PACVD technology" by K. Lukaszewicz, A. Paradecka and J. Wiśniewska on a page 40 presents the investigation of the microstructure and the mechanical properties of the CrN/DLC coating deposited by hybrid PVD/PACVD process onto the X40CrMoV5-1 hot work tool steel substrate. The microstructure of the investigated coating was observed on the scanning electron microscope and transmission electron microscope. Tests of the coatings' adhesion to the substrate material were made using the scratch test. A friction coefficient and the wear of coatings were determined in a test according to the ball-on-disk method. It was found out that the microstructure of the CrN layer consisted of fine crystallites, while their average size fitted about 10 nm. The low-friction DLC show an amorphous character. The coating demonstrated a satisfactory adhesion to the substrate. The values of the critical load L_{C1} and L_{C2} of investigation coating account for, respectively, 9 and 39 N. In sliding dry friction conditions, after the break-in time, the friction coefficient for the investigated elements is set in the range between 0.03-0.06. The investigated coatings reveal high wear resistance. Economically efficient process improvement, increased production efficiency and quality and products reliability through increased durability and unfailling operation time of tools for plastic formation of non-ferrous metals and improved usable properties shall guarantee measurable economic effects to the manufacturers and users of the products. Moreover, it will enhance their competitiveness both on the domestic and overseas markets. The Authors' original approach was the development of a double-layer coating within one process. Such a coating consists of the internal hard PVD layer providing appropriate hardness, strength, low thermal conductivity and restricting the impact of external factors on the wear process and the external low-friction layer providing good tribological properties.