

# Preface

Dear Distinguished Delegates and Guests,

The Organizing Committee of ICKEM 2015 warmly welcomes you to the 2015 5th International Conference on Key Engineering Materials (ICKEM 2015), held on March 21-23, 2015 in Singapore. ICKEM 2015 is sponsored by IACSIT of Singapore.

The conference is aimed at providing a platform for all of you to present leading-edge work in the fields of Key Engineering Materials. More than 300 papers were submitted to ICKEM 2015 and only 50% of them are accepted for the conference after peer reviewed by reviewers drawn from the scientific committee, external reviewers and editorial board depending on the subject matter of the paper. Reviewing and initial selection were undertaken electronically. After the peer-review process, the submitted papers were selected on the basis of originality, significance, and clarity for the purpose of the conference. The selected papers and additional late-breaking contributions to be presented as lectures will make an exciting technical program. The conference program is extremely rich, featuring high-impact presentations.

The proceeding records the fully refereed papers presented at the conference. The main conference themes and tracks are Material Sciences and Engineering. The main goal of ICKEM 2015 is also to provide international scientific forums for exchange of new ideas focus on Material Sciences and Engineering.

We would like to thank the program chairs, organization staff, and the members of the program committees for their work. Thanks also go to all those who have contributed to the success of ICKEM 2015.

Hopefully, all participants and other interested readers benefit scientifically from the proceedings and also find it stimulating in the process. We hope all of you have a unique, rewarding and enjoyable week at ICKEM 2015 in Singapore.

With our warmest regards,

Prof. Haider F. Abdul Amir, School of Science and Technology, Universiti Malaysia Sabah, Malaysia

Prof. Alexander M. Korsunsky MA DPhil CPhys MInst, Professor of Engineering Science and Fellow, Trinity College, Oxford, UK

Prof. Maria Mucha, Technical University of Łódź, Poland

March 21-23, 2015

Singapore

# Committees

## Honorary Chairs

Prof. Shamsuddin B. Sulaiman, Universiti Putra Malaysia, Malaysia

## International Advisory Committees

Professor LI Yi, National University of Singapore, Singapore

Professor Hu Xiao, Nanyang Technological University, Singapore

Professor Qingping Sun, Department of Mechanical Engineering, The Hong Kong University of Science and Technology, Hong Kong

## Conference Chairs

Prof. Haider F. Abdul Amir, School of Science and Technology, Universiti Malaysia Sabah, Malaysia

Prof. Alexander M. Korsunsky MA DPhil CPhys Minst, Professor of Engineering Science and Fellow, Trinity College, Oxford, UK

Prof. Maria Mucha, Technical University of Łódź Poland

## Program Committee Chairs

Prof. Kun-Li Wang, National Taipei University of Technology, Taiwan

Prof. Hendra Suherman, Universitas Bung Hatta, West Sumatera, Indonesia

Prof. Waldemar Grzechca, Silesian University of Technology, Poland

Prof. Horia Gavrilă, University Politehnica of Bucharest ROMANIA

Prof. Tanakorn Wongwuttanasatian, Khon Kaen University Thailand

Prof. Pasala Sarah, Vice Principal, Professor and Dean, R&D, Vardhaman College of Engineering, India

Prof. NASSER TOWHIDI, University of Tehran, Iran

## Technical Committees

Prof. Pranut Potiyaraj, Chulalongkorn University, Thailand

Dr. Makabe Chobin, University of the Ryukyus, Japan

Prof. B.S. Satyanarayana, R V College of Engineering, India

Asso. Prof. Amnart Suksri, Khonkaen University, Thailand

Khin Sandar Tun, Institute of Technical Education, Singapore

Asst. Prof. Rinlee Butch Cervera, University of the Philippines, Philippines

Assist. Prof. Phongsak Phakamach, North Eastern University, Thailand

Prof. Dr Muhammad Yahaya, Universiti Kebangsaan Malaysia

Asso. Prof. Halim Abdurrachim, Institut Teknologi Nasional, Bandung, Indonesia

Dr. Mohammad Kamal Hossain, King Fahd University of Petroleum and Minerals, Saudi Arabia

Dr. Zahid Qamar, Sayyad, Sultan Qaboos University, Oman

Prof. Naoufel Kraiem, Sultan Qaboos University, Muscat, Oman

Asso. Prof. Dr. Zawawi Bin Daud, Universiti Tun Hussein Onn Malaysia, Malaysia

Dr. Beddiaf ZAIDI, LSC, University of Badji Mokhtar, Annaba, Algeria

Majid Al-Maharbi, Sultan Qaboos University Sultanate of Oman

I-Fang Cheng, National Applied Research Laboratories, Taiwan

Mary Donnabelle Balela, University of the Philippines, Philippines

Boualem EL KECEBOUR, University of Sciences and Technology Houari Boumediene (USTHB),

Bab Ezzouar, Algiers, Algeria

Nor Aini Wahab, Universiti Teknologi MARA, Malaysia

Dauletkhan Smagulov, Kazakh National Technical University after K. Satpayev, Kazakhstan  
Tjokorda Gde Tirta Nindhia, Udayana University, Bali, Indonesia  
S M Sohel Murshed, University of Lisbon , Portugal  
R.Vasudevan, VIT University, Vellore, Tamilnadu, India.  
T.Stephen Sathiaraj, University of Botswana, Botswana  
Siew-Teng Ong, Universiti Tunku Abdul, Malaysia  
Jinan Basheer Ahmed Al-dabbagh, Malaysia  
Denni Kurniawan, Universiti Teknologi Malaysia Malaysia  
Lee Siew Ling, Universiti Teknologi Malaysia, Malaysia  
S. Ramesh, GITAM University-Hyderabad Campus, India  
Maryam Safaei, Research Institute of Petroleum Industry (RIPI), Catalysis & Nanotechnology  
Research Division, Iran  
Javad Jafari Fesharaki, Islamic Azad University, Najafabad Branch, Isfahan, Iran  
Geetesh Goga, K.C. College of Engg. , India.  
Nur Hashimah Binti Alias, UiTM Shah Alam, Malaysia  
N. Balasubramanian, A.C. Tech Campus, Anna University, Chennai-600 025 India  
M.K.A.Ariffin, Universiti Putra Malaysia, Malaysia  
Noor Najmi Bonnia, UiTM Shah Alam, Selangor., Malaysia  
Azlinda Binti Azizi, UiTM Shah Alam, Malaysia.  
Zahid Qamar, Sayyad, Sultan Qaboos University, OMAN  
R.H.Y.Subban, Universiti Teknologi MARA, Malaysia  
Nor Sabirin Mohamed, University of Malaya, Malaysia  
N.A. Ramlee, Universiti Teknologi MARA, Malaysia  
Yusri Yusof, Universiti Tun Hussein Onn, Malaysia  
Badrul Munir, Jakarta State Polytechnic, Depok, Indonesia  
Moj Raj Bagale kathmandu university Nepal  
Nazar Elfadil Mohamed Dean, College of Computing, Fahad bin Sultan University, Kingdom of Saudi Arabia

## **Sponsors**

International Association of Computer Science and Information Technology, Singapore