CSIR - INDIAN INSTITUTE OF TOXICOLOGY RESEARCH

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

Golden Jubilee Lecture

September 02, 2015

Professor Bikramjit Basu

Materials Research Centre,
Indian Institute of Science
Bengaluru

1965 50 2015 iitr स्वर्ण जयन्ती

50 Years of Service to the Nation

Professor Bikramjit Basu

PhD, FNASc, FWAST, FBAO

Dr Bikramjit Basu is currently a full Professor at the Materials Research Center, Indian Institute of Science (IISc), Bangalore and also holds Adjunct faculty position at Indian Institute of Technology Kanpur (IITK). After his undergraduate and postgraduate degree in Metallurgical Engineering, he earned his PhD in Ceramics at Katholieke Universiteit Leuven, Belgium in March, 2001. After a brief post-doctoral stint at University of California, Santa Barbara; he joined IITK in November 2001 as Assistant Professor and promoted to Professor at IITK in March, 2012. Over close to last two decades, Bikramjit Basu has made outstanding contributions first to the field of Engineering Ceramics and lately to Biomaterials, wherein he has brought in a strong materials engineering perspective to address biologically and clinically relevant problems. As part of translational research, he has led a team of clinicians and biomedical entrepreneurs to develop Indian patient-specific hybrid polymer-ceramic and zirconia-toughened alumina based femoral ball head and acetabular socket prototypes for total hip replacement surgery and this patented technology is being licensed to Maxx Orthopedics, Inc, USA.

An ardent believer in interdisciplinary research, Prof. Basu has successfully accomplished multiple research projects with total funding of more than 15 crores from ISRO, DAE, DST, CSIR, DBT and DRDO. As Principal Investigator of multi-institutional research programs on biomaterials funded by Indo-US Science and Technology forum (2008-2012) and UK-India Education & Research Initiative, UKIERI (2009-2012), he has played a pivotal role towards the success of multiple bilateral projects in the area of orthopedics and cardiovascular tissue engineering. His collaborative research with Brown University on developing PLGA-carbon nanofiber based cardiac patches has received media attention worldwide. In the context of osteoporosis treatment, one of the landmark outcomes of his UKEIRI project has been to establish long term implant stability and osseointegration of a new generation of strontium-substituted glass ceramic implants in rabbit animal model. Currently, he is the principal investigator of a large mission-oriented project with an interdisciplinary team of 15 active researchers from academia, national labs, hospitals and biomedical companies to establish Indian Government (Department of Biotechnology)-funded translational center of excellence on biomaterials for orthopedic and dental biomaterials.

Professor Basu's international standing and impact on the field are illustrated by his prolific publication record (more than 220 peer-reviewed journal articles, including 30 papers in journals with high impact factor (>4.0), more than 20 invited review papers/book chapters) and citation record (total citation: - 4,700, H-index: 38). He currently serves on editorial board of 12 SCI journals. A critical citation analysis by Elsevier-Scopus has placed him as the topmost Biomaterial scientist of India, based on publications during 2010-2015. He has authored three textbooks - one on Structural Ceramics (2011) and other on Tribology (2011) [both published by John Wiley & Sons, Inc.] and the latest on Biomaterials for bone tissue engineering applications (2015) [Springer]. Dr. Basu has taught for more than 14 years, served as a research adviser to 16 PhD students, 20 Masters students and mentored 10 young academic colleagues.

Prof. Basu's contributions in Science have been widely recognised. He is one of the youngest recipients from the Metallurgy/Materials Science community as well as the only Biomaterial Scientist so far to receive India's most coveted science award, Shanti Swarup Bhatnagar award (2013). He is an elected Fellow of the National Academy of Sciences, India (2013), West Bengal Academy of Science and Technology (2014) and Society for Biomaterials and Artificial Organs (2014). He remains the only Indian from India to receive the prestigious 'Coble Award for Young Scholars' (2008) from the American Ceramic Society.

Summarizing, his broad and productive scholarship in terms of impactful research publications including highly cited review papers, authoritative textbooks, leadership in multi-institutional research projects and outreach activities to excite young minds have established him rightfully as one of the internationally recognized foremost biomaterial scientists from India.

Patient-specific femoral ball head and acetabular socket for total Hip Joint Replacement: Labscale research to prototype development

Bikramjit Basu
Materials Research Centre
Indian Institute of Science, Bengaluru- 560012, India.

Abstract

It is broadly recognized that some of the existing clinical challenges in orthopedic applications include long term implant stability, faster healing process and affordability. Skeletal disorders continue to be the most widespread problem, particularly with increasing rate of trauma and diseases such as osteoporosis and osteoarthritis, most often occur in aging population. With increasing life expectancy of human beings particularly in India, there is an extremely high demand for such implant materials. Synthetic implant materials serve as the solutions for these problems, as surgical implantation of these artificial biomaterials help in the repair and replacement of diseased and damaged parts of the human skeleton, bone, teeth and joints thereby restoring the function of the otherwise functionally compromised structures. For load bearing applications, the implant should possess excellent biocompatibility, superior corrosion resistance in body environment, excellent combination of high strength and low modulus (matching with host bone), high fatigue and wear resistance, high ductility and osteointegration with surrounding tissues. In the above perspective, the first part of this presentation will demonstrate the efficacy of an integrated manufacturing approach to develop Indian patient-specific acetabular socket based on hybrid polymerceramic composites in compression molding route. The use of optimised compression molding parameters as well as polymer rheological abrasive finishing to obtain smooth surface finish of the sockets will be highlighted. Various challenges in translating lab scale research to prototype development will be discussed. In the second part of the presentation, our recent research results will be presented to illustrate how to develop the Zirconia-toughened Alumina (ZTA) based femoral ball head/acetabular socket prototype using integrated manufacturing steps to obtain smoothly polished femoral ball heads together with better strength, fracture toughness and wear resistance properties. In particular, the multi-piece integrated cavity steel mould was designed with the aid of the ABS acetabular socket/femoral prototype dimensions. While presenting the research results, it will be illustrated how to carefully tailor presintering-machining of green compact-final sintering parameters. The dimensional stability was monitored closely at all stages to understand the shrinkage behaviour, shape, and dimensional accuracy. The presentation will conclude with the future scope of materials development, property validation and the commercialisation aspect of the adopted manufacturing approach to produce the cost-effective biomedical devices for affordable human healthcare.

CSIR-INDIAN INSTITUTE OF TOXICOLOGY RESEARCH

(COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH)

CSIR-IITR, Lucknow is the only multidisciplinary research institute in the field of toxicology in South East Asia with the motto:

Safety to Environment & Health and Service to the Nation

R&D Areas

- Food, Drug & Chemical Toxicology
- Environmental Toxicology
- Regulatory Toxicology
- Nanotherapeutics & Nanomaterial Toxicology
- Systems Toxicology & Health Risk Assessment

Services Offered

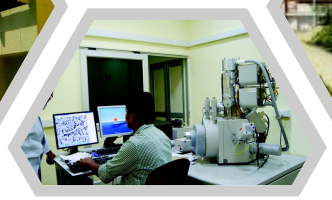
- GLP certified for pre-clinical toxicity studies
- NABL accredited
- Safety / toxicity evaluation of NCEs
- Water quality assessment and monitoring
- Analytical services
- Environmental monitoring and impact assessment
- Epidemiological studies
- Information on chemicals / products

Recognitions

- Scientific & Industrial Research Organizations (SIROs)
- UP Pollution Control Board (Water & Air)
- Indian Factories Act (Drinking Water)
- Bureau of Indian Standards (Synthetic Detergents)
- Food Safety & Standards Authority of India (FSSAI)

Technologies Developed / Available

- Water Analysis Kit
- Mobile Laboratory Van for on spot water quality analysis
- Argemone Detection Kit for rapid screening of Argemone in mustard oil
- CD-Strip for detection of butter yellow, an adulterant in edible oils
- Arsenic Detection Kit



Director
CSIR-Indian Institute of Toxicology Research
MAHATMA GANDHI MARG, POST BOX NO 80,
LUCKNOW-226001 (INDIA)

+91 522-2621857, 2613357
director@iitr.res.in

Fax +91 522-2628227
www.iitrindia.org

Accredited by NABL for chemical and biological testing

Toxicity Testing: GLP Test Facility