

Emerging Technologies Forum

Rare Earth Elements and their Applications

Date: 25 October 2013 (Fri)

Time: 2:00pm to 5:30pm

Seats will be reserved on a first-come-first-served basis. Interested parties please **register online** at: www.cityu.edu.hk/kto OR complete and return the registration form to us by **17 October 2013** via: Fax: 3442 0883 or Email: cubic@cityu.edu.hk. Notification on successful registration will be sent via email by 22 October 2013.

Registration Form

To : CityU Business and Industrial Club (CUBIC)

Name : (*Prof / Dr / Mr / Ms) _____

Position : _____

Organization : _____

Phone : (Office) _____ (Mobile) _____

Email : _____

Address : _____

Are you a CUBIC member? *Yes / No

(* please delete as appropriate)

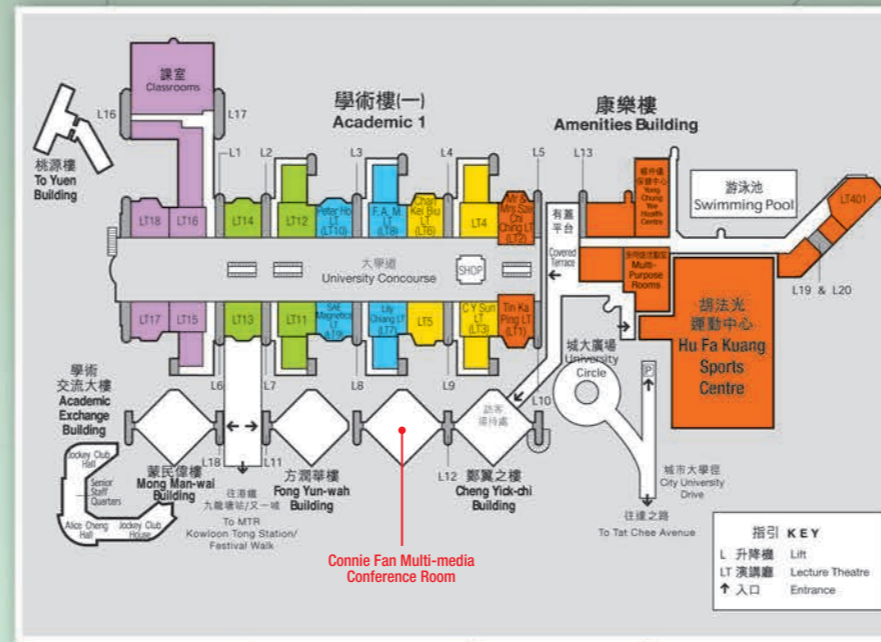
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Website: <http://www.cityu.edu.hk/kto>

Location map of venue



Emerging Technologies Forum

Rare Earth Elements and their Applications

25 October 2013



Venue:

Connie Fan Multi-media Conference Room
4/F, Cheng Yick-chi Building
City University of Hong Kong
Tat Chee Avenue, Kowloon

Language:

Cantonese/English

Admission:

Free



Supporting Organizations:



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Programme

Time	Activities
2:00 – 2:25pm	Registration
2:25 – 2:30pm	Welcoming Remarks
2:30 – 3:00pm	Presentation 1: <i>A Strategic Feasibility Study for Hong Kong to Upgrade Innovation and Technology Industries Through Rare Earth Elements (REEs)</i> Dr Lo Wai-yin , Senior Consultant, Materials and Manufacturing Technology Division, Hong Kong Productivity Council
3:00 – 3:30pm	Presentation 2: <i>Rare Earth Elements as High Performance and Transparent Electrodes in OLED</i> Dr Roy Fung , Senior Research Fellow, Department of Physics and Materials Science, CityU
3:30 – 4:00pm	Presentation 3: <i>Rare Earth Magnet Manufacture: Between the Tightening Raw Material Supply and Cut-throat Competitions from Mainland Companies</i> Mr Horris Leung , Director of Business Development, TDK China Co., Ltd.
4:00 – 4:30pm	Presentation 4: <i>Use of Rare Earth Elements in Engineering Components</i> Prof Lawrence Wu , Professor, Department of Physics and Materials Science, CityU
4:30 – 4:45pm	Q & A
4:45 – 5:30pm	Networking and refreshment

About the Speakers



Dr Lo Wai-yin has over 15 years of experience in industrial materials research and consultancy, assisting a diverse range of industries. He has a PhD in Chemistry and is currently serving Materials Testing Laboratory at Hong Kong Productivity Council responsible for failure analysis of materials and surface finishing products. Dr Lo has an excellent track record in previous research, especially those funded by ITF. He has also successfully commercialized and transferred a number of manufacturing technologies developed through ITF to Hong Kong industries, including electroplating, electroforming, ion plating, electrophoretic deposition, high power pulsed plasma magnetron sputtering, sputtering target fabrication, rare earth processing, etc. Dr Lo is an expert in technology development and technology transfer of production process and waste minimization for the local surface finishing industry. In addition, he has led his team in winning numerous awards in industrial technologies, such as Hong Kong Awards for Industries on Machinery and Machine Tools Design and Equipment Design. As a recognition of his significant contributions to industrial technologies and his distinctive expertise in materials, Dr Lo has been invited to participate as executive board member and/or adviser in a large number of industry associations in Hong Kong.



Dr Roy Fung has over 10 years of research experience in OLED and organic electronic devices. He is currently a Senior Research Fellow in the Department of Physics and Materials Science of CityU, Honorary Research Fellow in the CityU Shenzhen Research Institute, and a team leader of OLED Processing in the Center of Super-Diamond and Advanced Films (COSDAF). Dr Fung is actively involving applied research and industrial projects on OLED and nanostructural materials. His researches focus on OLED, organic electronics, nanoscience and nanotechnology, surface science and advanced thin films. So far, Dr Fung has published over 70 papers in internationally refereed journals, three book chapters and four patents. He has drafted and formulated 15 research projects for COSDAF with a total funding of over HKD 27 million. Recently, Dr Fung and his team, led by Prof Chun-Sing Lee, have made various breakthroughs in achieving high-efficiency and long-lifetime white OLED for general lighting. In particular, their project on "Transparent White OLED for Lighting" won the Best Product Award in the China Hi-Tech Fair in 2012.



Mr Horris Leung began his career in the semiconductor industry in Hong Kong in which period he traveled extensively working with customers in the South East Asia. He continued his studies at the University of Warwick in the late 1980's and remained with the University to research in the areas of computer aided design and computer aided manufacture. He rejoined the semiconductor industry briefly upon returning to Hong Kong in 1995 before he joined SAE Magnetics, the TDK company for magnetic recording heads, in 1996. Serving the company as the manager of tester development, he developed advanced testers and testing methodologies to support the R&D and manufacture of state-of-the-art magnetic recording heads for Hard Disk Drives (HDD). He is currently the Director of Business Development of TDK China, the operating entity of TDK in Greater China region, having the responsibilities of developing new business pillars to sustain the business growth of the company in the future. In academics, Mr Leung received his first qualification in Mechanical Engineering from the Hong Kong Polytechnic, an MSc in Information Technology for Manufacture from the University of Warwick, and an MSc in Electronic Engineering from the Chinese University of Hong Kong.



Prof Lawrence Wu is a BSc(Eng) and PhD graduate of the University of Bristol in Aeronautical Engineering. He also holds a Postgraduate Diploma in Management Studies from the University of West of England, Bristol. He is a Fellow of the Hong Kong Institution of Engineers (HKIE). He is also a former Chairman of the Materials Division, the Deputy Chairman of the Materials Discipline Advisory Panel, and a Council Member of the HKIE. He worked in Cathay Pacific Airways Limited for one year, mostly on aircraft structural installations. Prof Wu has been with CityU since 1987. He has published over 170 papers at refereed international journal and conferences in composite materials and structures, electronic packaging, electronic solder materials, solar cells and optical sensors for biological and gemology applications. Prof Wu has been working in materials and structural failure analysis for about 23 years. He has produced over 400 consultancy reports with the majority in engineering failure investigations. He is a regular consultant to Government Departments and major corporations.

Synopsis

A Strategic Feasibility Study for Hong Kong to Upgrade Innovation and Technology Industries Through Rare Earth Elements (REEs)

by Dr Lo Wai-yin, Hong Kong Productivity Council

The purpose of this study is to review the current rare earth trade policy. It will evaluate the feasibility of developing Hong Kong as a strategic industrial hub for manufacturing of high value-added rare earth specialty intermediate materials to supply the global demands of high-tech industries. With suitable industrial conditions in Hong Kong, this study recommends to develop a specific industry roadmap for rare earth specialty intermediate materials to guide research and development activities, infrastructure developments and technology partnerships. This roadmap should be drawn up in terms of timeframes of the next 5-10 years on specific products that possess high potential to achieve the best technological and economic outcomes. In addition, four intermediate materials have been identified: sputtering targets, permanent magnets, lighting phosphors and automotive catalysts. They possess strong potential to fuel the local demand in prominent industries, such as electronics, lighting and display, and automotive components. Such industries require a total amount of 1,400 tons annually of rare earth (oxide) materials (about 4% of China total REO export 2010) to be imported at reduced rates from the mainland China without any restrictions. Finally, government support at local and/or national level is recommended to formulate specific policies on investment, infrastructure and technical training in order to provide sufficient economic incentives to further attract participation from local industries and foreign partners for the development of the rare earth specialty intermediate materials industry.

Rare Earth Elements as High Performance and Transparent Electrodes in OLED

by Dr Roy Fung, City University of Hong Kong

Our life would not be the same without rare earth elements. The functionalities of smartphones, tablet computers, laptops, televisions, hybrid and electric cars, solar cells, jet engines, satellite and communication systems, etc. all rely on rare earth elements. In the forum, the impacts of rare earth elements on Organic Light Emitting Diode (OLED), which is believed to be one of the most important flat panel display and lighting technologies in the 21st century, will be presented. Certain composites or alloys composed of rare earth elements such as Indium, Ytterbium and Samarium have very high optical transparency and conductivity, which have been proven to be indispensable electrode materials in flat panel display and lighting industries. Making use of indium tin oxide as an anode and our new device concept, we have achieved a natural white OLED light source with a maximum power efficiency of ~60 lm/W and a T50 lifetime of 240,000 hours. This white OLED will represent a viable replacement lamp in terms of efficiency and performance for the common incandescent and fluorescent lamps. In addition, with the novel use of rare earth metals as a transparent cathode, we demonstrated highly efficient transparent OLEDs as intelligent lightings. The device has dual-side illumination, which will open up novel applications such as partitions that are transparent in day time but capable of providing a pleasant diffused light at night.

Rare Earth Magnet Manufacture: Between the Tightening Raw Material Supply and Cut-throat Competitions from Mainland Companies

by Mr Horris Leung, TDK China Co., Ltd.

China controls 90% plus of Rare Earth (RE) supply to the world for the manufacture of high-tech products, including wind turbines for renewable energies, LED (Light Emitting Diodes) for solid state lighting, RE magnets for motors used in electric appliances, hard disk drives, automobiles, and so on. RE prices skyrocketed a few times within a few months in 2010 to 2011 when the Chinese government began to tighten the export control of the materials. With the supply of RE resources outside China, which include deserted mines and new mines being developed elsewhere around the world, prices of RE have become more reasonable because of the prospective supplies, but yet a few elements of the RE family, including that for the manufacture of RE magnets, have been identified by the US Department of Energy to be liable to both medium- and long-term supply risks. Meanwhile Chinese manufacturers, with their leaner cost structures and quickly improving technical capabilities, have become more competitive in both national and international markets of RE magnets. The talk will be divided into two parts. First part is a general review on the evolution of the RE magnet industries and how the ecosystem has been impacted by the RE supply. The second part of the talk will be looking at Chinese companies emerging in the worldwide RE industries and the strategies in which leading companies can weather the competitions. It will also be looking at the technologies with which manufacturers of RE magnets can mitigate the supply risks of RE.

Use of Rare Earth Elements in Engineering Components

by Prof Lawrence Wu, City University of Hong Kong

In comparison with other chemical elements, rare earth elements (REEs) have relatively short history of discovery and applications. They are rarely used in bulk form. Instead, they are added in small quantities to some other materials for certain applications. From their traditional main applications in metals and alloys, REEs have been developed for many advanced technological developments, such as aerospace, communication, energy and environment. Newer applications include those in electronics, optics, magnets, and catalysts. The use of some of these technologies would help the development of certain industrial sectors in Hong Kong and China. In this talk, applications in alloys, electronic solders, energy production and optical sensors will be highlighted. Research activities on some of these technologies have been undertaken at CityU. For example, when REEs were added to electronic solders, their strength was increased. Examples of some of these researches will be outlined to provide an insight into why rare earth materials were chosen as additional elements to a certain material.