THE CHARLES HATCHETT AWARD SEMINAR 2018

HIGH ENERGY AND HIGH POWER BATTERIES FOR E-MOBILITY - OPPORTUNITIES FOR NIOBIUM

Nb Niobium
CHARLES HATCHETT AWARD

CBMM

IOM3
The Institute of Materials, Minerals and Mining

www.charles-hatchett.com

The Charles Hatchett Award

Niobium, element 41 in the periodic table, is a transition metal which is an important component in a wide range of materials. Its main use is as a microalloying addition in high strength steels for applications such as bridges, pipelines and car bodies. Niobium oxides are playing an emerging role in the development of new and advanced functionalized materials for applications in energy storage.

To recognise and celebrate the importance of niobium and its contribution to civilisation, the world's leading niobium producer Companhia Brasileira de Metalurgia e Mineração (CBMM) has initiated and sponsored the Charles Hatchett Award since 1979.

This accolade, named after the discoverer of niobium Charles Hatchett FRS, is awarded annually in association with the Institute of Materials, Minerals and Mining (IOM3) for the best paper on the science and technology of niobium and its alloys. The award process is administered by Beta Technology.

Each named author of the winning paper receives an engraved medal, made from a slice of pure niobium, which features a portrait of Charles Hatchett.

For the 2018 Charles Hatchett Award, over 1,000 papers, published in major journals and conference proceedings during the two year period 1st September 2015 to 31st August 2017, were reviewed. A short list of five papers was circulated to the International Panel of experts resulting in the selection of the winning paper for 2018.

International Panel

The International Panel is a group of six to nine international experts selected from around the world to provide an impartial assessment on the technical merit of the shortlisted papers.

Each of the International Panel members serves for a maximum of three consecutive years, but can be selected to serve another, non-consecutive period. The Chair is appointed by CBMM and is not governed by the three year rule.

In the 40 years of the Award, up to 2018, 82 eminent experts have served on the panel and several of our panel members are themselves past award winners.

Current Panellists

Dr. Mike Hicks
Chair of the International Panel // UK

Dr. David Porter
University of Oulu // Finland

Prof. Hani Henein
University of Alberta // Canada

Prof. Indradev Samajdar
Indian Institute of Technology (IIT) Bombay // India

Prof. Isabel Gutiérrez
University of Navarra // Spain

Dr. Kisoo Kim
POSCO Technical Research Laboratories // South Korea

Prof. Oscar Balancin
Universidade Federal de São Carlos // Brazil

2018 Charles Hatchett Award Winning Paper

Unraveling the Nature of Anomalously Fast Energy Storage in T-Nb_2O_5

Journal of the American Chemical Society, 139 (2017), 7071-7081.

Materials for batteries is an area in which there will be significant growth in the near future. Nb_2O_5 shows extremely attractive performance in terms of charge and discharge rates for Li-ions.

The award winning research proposes a mechanism to explain this behaviour, which is supported by experimental Raman spectroscopy measurements and vibrational modelling. In addition, the unique features of the Nb_2O_5 crystal structure which differentiate it from competing materials provide pointers to how further improvements may be made in the design of the next generation of conduction and storage materials.

The selection process of the Charles Hatchett Award is concerned with technical excellence and originality, but also takes account of the social, economic and environmental advantages of any proposed application of niobium.

The International Panel for the Charles Hatchett Award commented,

"The research is remarkable because of academic and commercial interest in the smart revolution era. The development of new materials with enhanced performance could give a significant impact on the market."

The award winners were presented with their medals at the Institute of Materials, Minerals and Mining (IOM3) 2018 Premier Awards Dinner, held in London on 3rd July.

2018 Charles Hatchett Award Winners

- Dongchang Chen
  USA
- Jeng-Han Wang
  Taiwan
- Tsung-Fu Chou
  Taiwan
- Bote Zhao
  USA/China
- Mostafa A. El-Sayed
  USA
- Meilin Liu
  USA

A copy of the paper is available:

https://pubs.acs.org/doi/pdf/10.1021/jacs.7b03141

The Charles Hatchett website provides further information on:

The Award

The history of the Charles Hatchett Award, the application criteria and selection process, including details of current and past international panellists.

Award Winners

A comprehensive list of all previous winners since the first award in 1979.

Resource Library

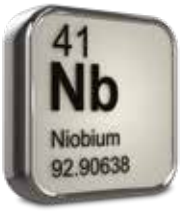
Access to winning papers, video presentations from the winning authors and highlights from previous seminars.

Charles Hatchett

Who was Charles Hatchett, when did he discover niobium and why is it also referred to as Columbium?

Niobium

Videos about the wide range of niobium applications and technical presentations.



40 Years of the Charles Hatchett Award – Impact Report

2018 celebrates a significant milestone in the history of the Charles Hatchett Award.

From 1979 to 2018, 163 medals have been awarded to authors representing 12 different countries, demonstrating the scale at which the award has established a community of leading scientists at a global level.

This knowledge-driven initiative, supported by CBMM over a significant period of time, has enabled the award to realise a number of benefits including:

- Recognising and rewarding leading scientists for world class work on niobium, building an international network of knowledge and expertise;
- Improving our understanding of the role of niobium in novel, advanced and functionalized materials and accelerating the development of a wide range of new products which have brought economic, societal, technical and environmental benefits in important market sectors such as oil and gas, energy generation and transport;
- Stimulating interest in new areas of research such as energy storage and lightweight alloys, and raising awareness of the potential of niobium with the next generation of scientists and Charles Hatchett Award winners of the future.

The full document will be available on the Charles Hatchett website.

www.charles-hatchett.com

Award Sponsor

Companhia Brasileira de Metalurgia e Mineração (CBMM)

Companhia Brasileira de Metalurgia e Mineração (CBMM) is the world's leading supplier of niobium and niobium technology.

Fully integrated from the mine to the final customised products, CBMM also provides expert technical support to customers in the most sophisticated steel and technological segments around the globe.

Headquartered in Brazil, CBMM has a technology subsidiary in Switzerland, commercial subsidiaries in Europe, Asia and North America, and an extensive worldwide network of strategically positioned supply warehouses.

The World's Leading Niobium Producer

CBMM was founded in 1955 in Araxá, Minas Gerais, Brazil, the site of a large niobium ore deposit. Decades of investment in niobium technology, niobium applications and customer service have earned CBMM the position of the world's leading niobium producer and the sole company present in all niobium market segments.

The company's team of over 1,800 highly trained, dedicated professionals is committed to providing cutting-edge niobium products to over 300 customers in 50 countries around the globe.

A Sustainable Enterprise

A commitment to the environment, employees and the community that dates back to CBMM's earliest days has solidified the company's reputation as a sustainable enterprise. In addition to numerous certifications and honours, including being the first mining and metallurgy company in the world to earn ISO 14001 certification, CBMM's mission is sustainable:

> Expand the use of niobium technology, transforming a natural resource into solutions to build a better world.

CBMM

www.cbmm.com

www.charles-hatchett.com

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Maxwell Library, The Institute of Engineering and Technology,
London, 4th July 2018

Agenda

09.00	Assemble and Coffee	
09.30	Welcome and Introduction	Prof. Richard Walton, University of Warwick, UK
09.35	Current Status and Future Trends of the Global Li-ion Battery Market	Dr Christophe Pillot, AVICENNE ENERGY, France
09.55	The Impact of 40 years of the Charles Hatchett Award and Introduction to the 2018 Winners	Dr Mike Hicks, Chair of the International Charles Hatchett Panel, UK
10.10	The Charles Hatchett Award 2018 Lecture "Unraveling the Nature of Anomalously Fast Energy Storage in T-Nb_2O_5"	Dr Dongchang Chen, Lawrence Berkeley National Laboratory, Berkeley, California, USA
10.50	Coffee	
11.20	Next-generation Li-ion Battery with New Anode Material Containing Niobium	Shun Egusa / Dr Yasuhiro Harada, Toshiba Corporation, Japan
11.45	High Energy Density Cathode Containing Niobium	Jon Jacobs, WildCat Discovery Technologies Inc, USA
12.10	Electric Vehicle Research Challenges at Renault	Pierre Tran-Van, Renault, France
12.35	Electric Vehicle Battery Chemistry and Pack Architecture	Fabrice Robert / Cedric Weiss, A2Mac1, France
13.00	Discussion and Concluding Remarks	João Oliveira, CBMM, Brazil
13.15	Lunch and Networking	

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