

May | 2019

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## INTRODUCTION

### WELCOME

**Welcome to this latest Mobility Newsletter from CBMM.**

The purpose of this Newsletter is to share news, information and insights – with partners and stakeholders who are interested and involved in progressing important Mobility issues.

This issue explores the trends and growth in Micro mobility and Nanocrystalline materials, and explores the potential and value of Niobium materials technology in a range of applications.

The Newsletter also includes highlights from the recent CBMM & Partners Hong Kong Tech Day Workshop and Formula E E Prix – and looks forward to the forthcoming Berlin Tech Day Workshop and Formula E BMWi E Prix Presented by CBMM Niobium.

CBMM is committed to developing mutual understanding and partnerships with regard to innovative and effective approaches to... Materials Technology, E Mobility & Smart Cities. It is only possible to cover chosen subjects in high-level detail, so for most subjects, contact information is provided, to encourage further subject exploration, communication and understanding.

We hope that you find this communication interesting and valuable, and so we look forward to receiving any feedback on this Newsletter issue.

Very Best Regards



**Rodrigo Amado**

*Head of Mobility CBMM*





## TRENDS IN MOBILITY

Electric scooters, docked and dockless shared bikes, and other vehicle types are shrinking the physical footprint needed to move people over relatively short distances. Collectively dubbed micromobility, these services have clearly resonated with consumers, as evidenced by their rapid adoption in many major cities, in recent times. Innovative micromobility products and services have the potential to better connect people with public transit, reduce reliance on private cars, and make the most of existing space by “right-sizing” the vehicle, all while reducing greenhouse gas emissions.

Over half of the world’s population now lives in urban areas, and that could climb to two-thirds by 2050. All of those people will need to move. Demand for urban passenger-miles across all

### MICROMOBILITY – SIZE MATTERS

modes could almost double between 2015 and 2050. While mass transit remains the most efficient means of moving large numbers of people long distances, getting people to and from transit remains a major difficulty—the much-discussed first-mile/last-mile challenge. If people lack a convenient, affordable way to get on a bus or train, they are far more likely to opt for a personal vehicle, contributing to the gridlock and poor air quality that plagues so many cities.

Micromobility’s potential however extends beyond simply connecting people to mass transit. More than half of the car trips taken annually in the United States cover less than five miles, making those journeys open to short-range alternative modes such as e-scooters and bikes.



The continued growth of Micromobility looks inevitable, though great design, technical innovation – including use of advanced materials like Niobium, and supporting city infrastructure, will all help to drive market growth.



# ■ NANOCRYSTALLINE

## Setting up the future of EVs

Improvements in battery and other component technology has boosted production. EVs continued to witness double-digit growth with more than 2 million EVs sold in 2018. By 2025, public transport is expected to reach approximately 38 million units. This totals 55 million units of EV and Hybrid light cars, medium- and heavy- duty trucks and buses.

Every day, the automotive industry faces more restrictions related to efficiency, environmental concerns, and low CO2 emissions. This will cause conventional materials to be reduced, and the industry will have to start exploring new types of materials, migrating and finding new alternatives.

Today the technology and improvements achieved are satisfactory for the industry, still, OEMs and Tier 1 are redirecting their R&D resources to fully develop what it sights to be a very promising industry.

Crucially, technology is developing around available materials, shaping the future of EVs and its adoption. The EV industry is looking for new materials that can positively impact the vehicle weight, battery performance, power efficiency, charging time and range. High-grade MNC (Metallic Nanocrystalline Material) adoption in EMC filters, communication and voltage control system could improve several performance aspects in order to achieve the desirable efficiency and the eco-friendly vehicle, not dependant on fossil fuels, that customers are increasingly demanding.

Some of the trends influencing innovation currently and in the medium and long term includes the “green mindset” and focus on CO2 emissions and other environmental issues, as well as the need for more energy to power Smart Homes, EVs and other devices that will mark a very different future.

For further information about the value of niobium technologies contact Rogerio Magalhães Pastore  
[rogerio.pastore@cbmm.com](mailto:rogerio.pastore@cbmm.com)



# FUTURE TECHNOLOGIES & VALUE – NOW

## Efficient E Engines

Niobium based materials (Nanocrystalline materials) are more efficient than currently used materials in the process of converting electrical energy from the battery into motion, especially in higher frequencies, playing an important role not only in recently developed electric motors, but also in inverter components.

## Safer Batteries

Niobium can increase battery performance, for example, by improving service life and safety. Niobium enables the development of new electrode materials directed towards increasing the amount of stored energy or enabling faster charging times. The niobium-containing electrode capable of fast-charging also helps prevent short circuits that cause fires, resulting in safer batteries with longer life cycles.

## Better Drivetrain, Brakes and Wheels

Niobium technologies can make gearboxes, gears, and transmissions lighter, stronger and more resistant to wear and failure. Niobium in aluminium or steel wheels can make them lighter and stronger while also allowing for more innovative designs. The application of niobium in brake rotors significantly increase its fatigue resistance, allowing for longer service life or lightweight designs.

## Stronger Structures

Niobium's benefits include increasing lightness, strength and toughness whilst simultaneously improving formability and weldability of key components. In addition, Niobium can significantly improve production process efficiencies making vehicles easier and cheaper to produce. Possible weight savings of between 10% and 20% in vehicle parts and up to a 15% reduction in steel volumes. Typical structural applications include: vehicle chassis frame, body panels, and other steel and aluminium components.

## Smart Windows

Niobium oxide glass is under development to create smart windows that can dynamically control the amount of visible sunlight and solar heat into a vehicle. Niobium smart windows improve the driver and passenger experience and enable fuel savings whilst decreasing CO2 emissions.

## Advanced Engines

Niobium technologies can make engine blocks and cylinder heads lighter, stronger and more resistant to wear and failure. The inclusion of Niobium also allows for more complex and innovative designs to be produced without loss of performance or reliability.

## Resilient Electronics

A range of niobium products can be used to produce capacitors, inductors and other components including... Sensors e.g. rain, light sensor, seat weight, gear box, drive train, temperature, parking, tyre pressure, airbags and battery cell temperature - Electric Controls e.g. seat adjustment and heating, window and mirror adjustment, fuel, water, oil and water pumps, lamp/LED driver and electronic power steering and - Electronic Circuits e.g. air conditioning, GPS location system, infotainment, satellite radio, keyless system, cruise control, remote start, start-stop system, power converters, crash avoidance circuit, telematics control unit, dashboard systems and car alarms.

## Faster Wireless Charging

Niobium nanocrystalline materials can be used to improve magnetic shielding in wireless charging devices to improve the efficiency of charging, reducing electrical losses.



# FUTURE TECHNOLOGIES & VALUE – NOW

## ADVANCED MATERIALS TECHNOLOGY

Through its own R&D programmes and collaboration with technical partners, CBMM is constantly developing new product applications where Niobium can improve product qualities and performance characteristics.



## NIObIUM ADVANCED MATERIALS TECHNOLOGY

DELIVERING  
POSITIVE  
BENEFITS  
AND VALUE



### BETTER PERFORMANCE

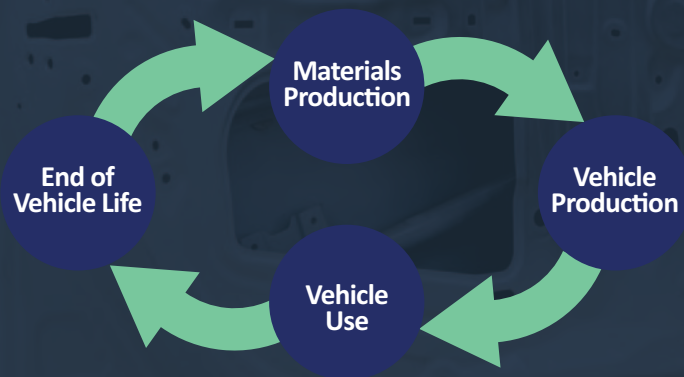
- Niobium produces stronger, lighter and tougher vehicles
- Possible weight savings of between 10% and 20% in vehicle parts
- Up to a 15% reduction in steel volumes
- Vehicles are easier to make and with better product quality



### IMPROVED SAFETY

- Niobium components are more wear resistant
- Niobium components are more reliable
- Lightweighting enables additional safety and comfort features

## Niobium increases sustainability in all stages of the automotive industry



### CLEANER ENVIRONMENT

- Niobium reduces use of materials and emissions
- Niobium reduces fuel consumption due to lightweighting
- Niobium components are 100% recyclable



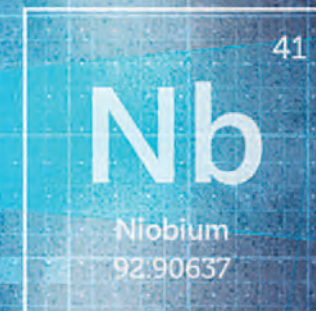
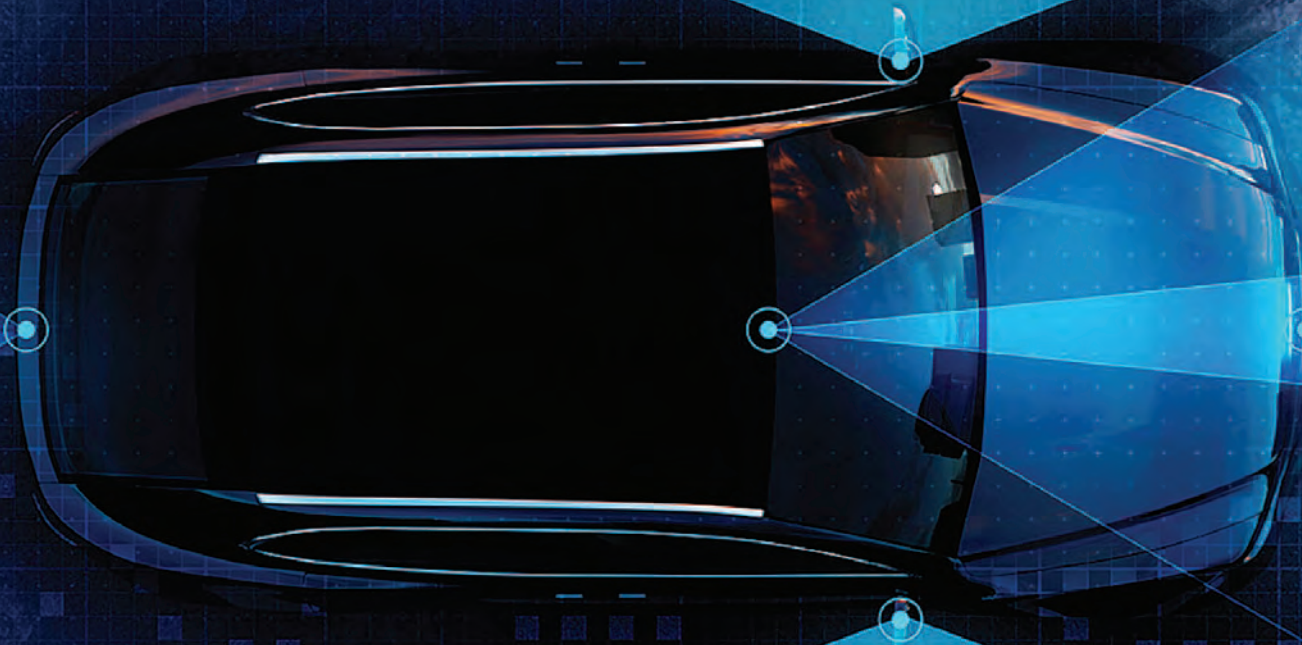
### INCREASED VALUE

- Niobium products last longer
- Lightweighting reduces fuel costs and tyre wear
- Niobium helps to reduce production costs



### ADVANCED TECHNOLOGY

- New Niobium applications are continuously being developed
- Stronger, lighter high-performance steels – and innovative Niobium aluminium products
- Niobium technologies are being developed for batteries, sensors, wireless charging and glass



## NIObIUM TECHNOLOGIES DELIVER VALUABLE MOBILITY SOLUTIONS

Niobium is an increasingly fundamental component of advanced materials. The applications of niobium are becoming more diverse – from its established role in high-strength steels to functional materials for energy and efficiency including ultrafast charging lithium-ion batteries with high energy density, superconducting wire for power transmission, electrochromic glass for smart windows, and nanocrystalline magnetic niobium alloy for wireless charging and other electronic applications.

Experts from across the automotive sector are demonstrating the power of niobium to play a

central role in the global transition toward electrification of transport. Lightweight but strong Nb-alloyed steel parts offer a route to lighten the load on batteries for electric vehicles, bikes, and scooters. Moreover, niobium-based battery materials are set to revolutionize e-mobility energy storage. Complex oxides based on niobium have demonstrated the fastest performance ever measured for a lithium-ion battery electrode material in a bulk and scalable material formulation. This means high power capabilities for lightning fast acceleration and rapid charging that will enable short pit stops on roadways as well as racetracks.

A key theme that resonates through all of these niobium technologies is increased energy efficiency. The mechanism of improved efficiency actually stems from the fact that whether in batteries, steels, or magnetic alloys — niobium acts to change the way atoms are arranged in the materials. In batteries, niobium functions as a structure-directing agent to create rigid and open frameworks for lithium-ions to move freely, which leads to their fast performance, high energy efficiency, and stability. In steel and magnetic alloys, niobium creates small domains that outperform their size and enable improved performance from compact, lightweight components. The unique

properties of niobium are helping to solve issues related to energy and to create a cleaner future.

Dr. Kent Griffith is currently a materials scientist at Northwestern University working on energy materials after being awarded his doctoral degree on next-generation battery chemistries from the University of Cambridge.

**For further information about the value of niobium technologies contact Kent Griffith**  
[kentgriffith@gmail.com](mailto:kentgriffith@gmail.com)

## IN THE NEWS

### HIGH-PERFORMANCE BRAKES

New high-performance brake disc containing niobium has been introduced in the market.

To solve cracking problems generated by thermomechanical fatigue in the brake discs used in the Stock Car competition, CBMM and HIPPER FREIOS started the development of a brake disc containing niobium. Test results showed improved performance in terms of high temperature resistance, fatigue and cracks. Due to the excellent results, the company has introduced the new product into the market. "Niobium Steel" is the brand name of the new line of brake discs with niobium contents up to 0.2 %, targeting the aftermarket for high performance vehicles.

The brake disc line called "Niobium Steel" was officially launched nationally in the last week of April during the AUTOMECA event.

For further information about improved performance brake discs contact Erico França – [erico.franca@cbmm.com](mailto:erico.franca@cbmm.com)



### SUPER CHARGED !

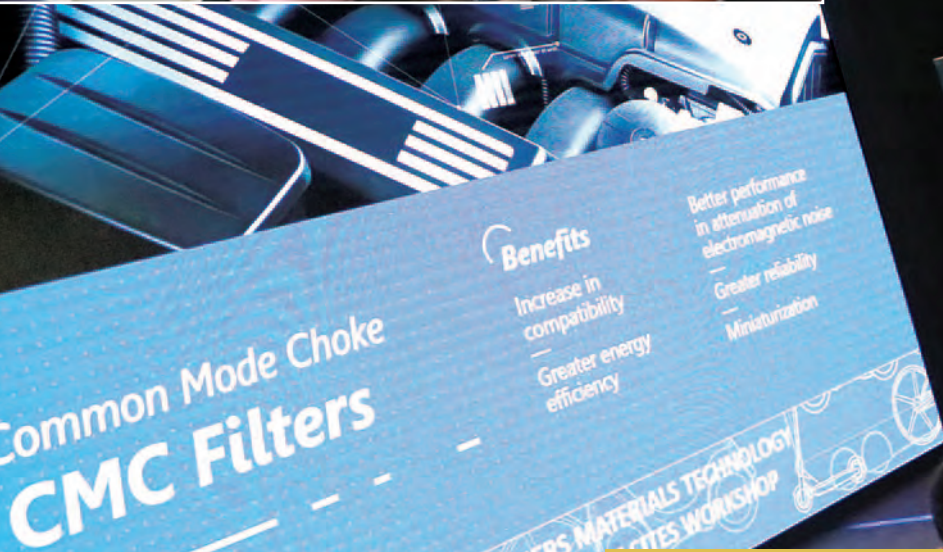
In April 2019 over 30 leading automotive specialists gathered in Huddersfield UK, to discuss innovation in advanced high-performance Turbocharger materials. The event was hosted by the Turbocharger Research Group (TRG) based at the University of Huddersfield and was co-organised by CBMM and TRG.

As the world's leading niobium CBMM is dedicated to niobium technology and the development of niobium applications including cast metals containing Nb alloy additions. Key presentations were made by Turbocharger and materials specialists BorgWarner, UniPol Holdings, Oxford University spin-off Oxmet and NiobelCon – though it was the discussions that followed, and that continued after the event, that have produced real value for all attendees.

For further information about high-performance Turbocharger materials contact Paul Lalley – [paul.lalley@cbmm.com](mailto:paul.lalley@cbmm.com)







*"I have a much better understanding of the applications and value of Niobium"*  
*Magna*

*"It has been an outstanding event, I have really enjoyed it"*  
*Baoshan Iron & Steel*

*"We learned a lot about Niobium applications, the workshop was an excellent place to share ideas"*  
*Beijing Easpring Material Technology*

## MOBILITY TECH DAYS & FORMULA E

### CBMM & PARTNERS HONG KONG TECH DAY WORKSHOP

Over 75 leading mobility and automotive OEMs, suppliers, academics and advisors from China, South Korea, Japan and elsewhere met in Hong Kong for the latest CBMM & Partners Tech Day Workshop on March 8.

The Tech Day Workshop explored issues, innovations and insights in a number of areas including vehicle lightweighting, battery technologies, nanocrystalline materials and EV cars. In particular, how Niobium plays a key role in producing innovative high-performance material technology was explored throughout the Workshop.

At the event, participants also met and talked with 2017 Formula E Champion Lucas Di Grassi, and heard about a new SUV race format being developed, EXTREME E that will be launched in 2021.

Feedback so far has been outstanding indicating that this unique opportunity to learn, share and network have been greatly appreciated – and that new partnerships have been formed to undertake future collaboration.

A number of presentations delivered at the Hong Kong Workshop are available [here](#).

For more information about the CBMM & Partners Tech Day Workshop Programme please contact [rodrigo.amado@cbmm.com](mailto:rodrigo.amado@cbmm.com)

## CBMM & PARTNERS HONG KONG FORMULA E EXPERIENCE

Following on from the Hong Kong Tech Day Workshop, the group visited the Formula E track for a unique 'back-stage' opportunity to visit race team garages. The next day the CBMM group also went on to experience the high-performance and high-drama of race day in Hong Kong – allowing them to fully appreciate the power, safety and other important characteristics of electric racing vehicles.

Here are some additional comments from those who had this special experience:

*"The workshop, the race and the organisation were excellent"*

McLaren

*"The workshop, the garage tour, the hospitality and the race experience have all been fantastic – thank you to CBMM"*

Euromonitor

*"It's great that CBMM guests have a unique opportunity to experience the power and potential of Formula E and the role it plays in creating an exciting e mobility future"*

Lucas Di Grassi



## FIA SMART CITIES SUMMIT HONG KONG

CBMM was invited to participate in the Hong Kong Smart Cities Forum, attended by over 500 invited guests – by joining a panel to discuss Automotive Technologies for Smart Cities.

CBMM's Rodrigo Amado outlined how the development of advanced materials including Niobium Technologies, could play a key role in delivering a better, brighter future for our cities.

By 2050 the world urban population is expected to nearly double, making urbanisation one of the 21st century's most transformative trends. Cities around the world are currently rethinking their urban policies, with a focus on sustainability and mobility playing a central role in this process. The FIA Smart Cities initiative was launched in 2017 to encourage the relevant stakeholders to address these pressing concerns and discuss potential solutions to fill in the gaps in modern mobility systems.

The FIA Formula E platform provides a unique arena for the FIA Smart Cities initiative along with the FIA's expertise in its complementary pillars of Mobility and Sport. This urban-focused fully electric championship is hosted in city centres around the world, one of the objectives being to promote interest in sustainable motoring and showcase the use of innovative clean technologies.

For more information about the FIA Smart Cities programme please click [here](#).



Julius Bär



## CBMM & PARTNERS BERLIN TECH DAY & E PRIX

The latest CBMM & Partners Tech Day Workshop is planned for May 24 in Berlin. Approximately 75 leading mobility and automotive OEMs, suppliers, academics and advisors from Europe and the rest of the World, will meet to explore important mobility trends, initiatives and case studies.

Interactive Tech Day Workshop presentations and discussion will cover a range of stimulating topics including... vehicle lightweighting, battery technologies, power electronics, autonomous and electric vehicles. And in addition, the role Niobium plays in producing innovative high-performance material technology solutions will also be explored.

At the event, participants will have an opportunity to meet and hear from the 2017 Formula E Champion Lucas Di Grassi, and will also be able to meet Formula E teams as well as experiencing first-hand all that exciting electric street car racing has to offer.

For more information about Formula E and the Formula E BMWi Berlin E Prix – presented by CBMM Niobium – click [here](#).



## ■ OPPORTUNITIES TO COLLABORATE

### BUILDING THE FUTURE TOGETHER

A team of 1,700+ CBMM professionals is committed to providing cutting-edge niobium products and technology to more than 300 customers in 50 countries.

CBMM's technology initiatives and innovations are developed in two ways. First, the company's Technology Center is located at the world leading industrial complex in Araxá, Brazil and focuses on enhancing the production processes of existing niobium products and at the same time developing exciting new products.

The company also has a technology subsidiary, CBMM Technology Suisse, based in Geneva which coordinates efforts to develop new niobium applications worldwide.

For over 20 years CBMM has successfully partnered with a number of leading international organisations to research, develop and introduce new technologies to automotive, mobility and other markets.

Current partners include:

- Leading Universities in China, Europe and North and South America
- Technology R&D and Innovation Consultancies around the world
- Tier 1 & 2 Suppliers around the globe
- Established OEMs and new entrants into the automotive and mobility sectors

To explore and discuss opportunities for potential partnership to develop and apply new high-value materials technologies, please contact CBMM Head of Technology Rafael Mesquita [rafael.mesquita@cbmm.com](mailto:rafael.mesquita@cbmm.com)



## CONTACT

### FOR MORE INFORMATION

If you would like to know more about CBMM's mobility programmes – please contact CBMM Head of Mobility Rodrigo Amado at: [rodrigo.amado@cbmm.com](mailto:rodrigo.amado@cbmm.com)

And you can click [here](#) to find out more about niobium technologies and mobility programmes.

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**CBMM**  
Niobium N5

