The 2nd Graphene Flagship EU-UAE Workshop on Graphene and related 2D materials

6 September 2023, Gothenburg (Sweden)

Workshop Report

Workshop Chairs:

Prof. Hassan Arafat, Khalifa University and RIC2D (United Arab Emirates)

Dr. Kari Hjelt, Chalmers Industriteknik (Sweden)

Overview

The 2nd EU-UAE workshop on Graphene and related 2D materials was held on 6 September 2023 in Gothenburg (Sweden) and was organised as part of the scientific programme of the Graphene Week 2023 conference. This event was the follow up of the successful 1st EU-UAE workshop, held in May 2023 in Abu Dhabi, United Arab Emirates (UAE) and was jointly organised by the Graphene Flagship and the Research & Innovation Center for Graphene and 2D Materials (RIC2D) at Khalifa University.

The workshop has focused on the presentation of ongoing research activities and real-world technology transfer applications involving graphene and 2D materials in the UAE and Europe. The session was joined by key business developers and industry representatives from the Graphene Flagship and from relevant stakeholders from the UAE.

After the opening remarks by the two chairs of the workshop, Prof. Hassan Arafat (Khalifa University, RIC2D) and Dr. Kari Hjelt (Chalmers Industriteknik, Graphene Flagship), 8 presentations were given by representatives of Graphene Flagship industry partners and business developers as well as UAE partners, each presenting relevant research and innovation actions involving graphene and 2D materials and addressing important technological and societal challenges. The presentations were followed by a panel discussion with Q&A.

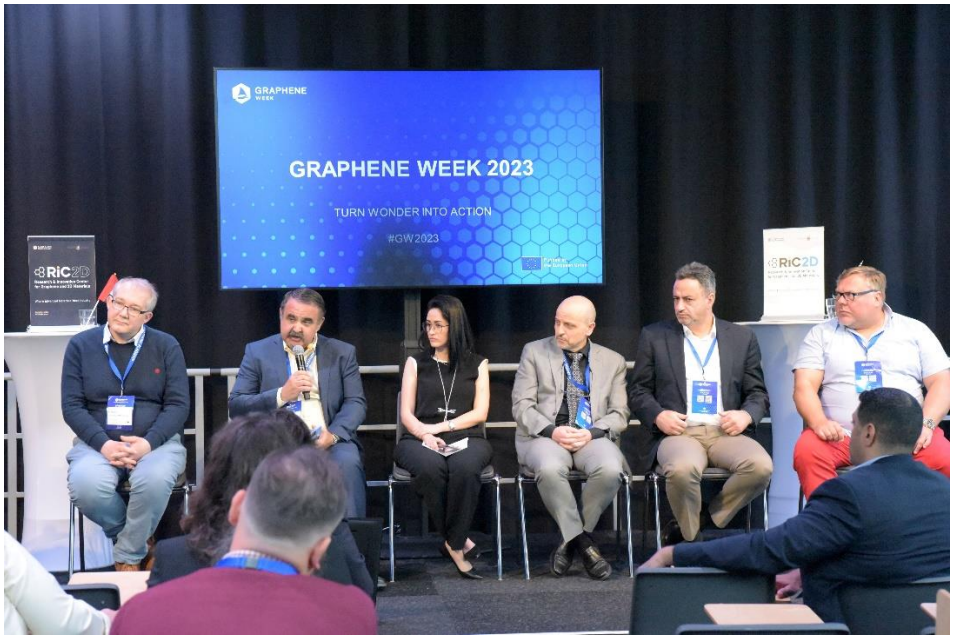

Figure 1: Panel discussion and Q&A during 2nd EU-UAE workshop.

Common challenges and opportunities for collaborations

Research and technology areas such as construction, energy production and storage, aerospace and water purification were confirmed as major common topics of interests for both EU and UAE representatives. The representatives from both delegations agree that graphene and 2D materials are very promising enablers to progress in these key areas and address relevant technological, environmental and societal challenges. The synergy between the graphene and 2D materials-based innovations activities carried out by the EU and the UAE in such areas is further shown in both already established collaborations (*e.g.,* the association of RIC2D at Khalifa University with the Graphene Engineering Innovation Centre (GEIC) of the University of Manchester for delivering a funding boost to graphene innovation and collaboratively addressing some of the main global challenges,[1] or between Levidian and Zero carbon Ventures for high quality graphene and hydrogen production and distribution, tackling energy decarbonization in the UAE[2]) and newly built partnerships currently being implemented (*e.g.,* signature of an MoU between Graphmatech and RIC2D to collaborate on advanced graphene-engineered materials and manufacturing processes[3]).

The workshop saw a large attendance from the Graphene Week participants, who showed their interest in this international collaboration by actively engaging with the speakers during and after the session. Inspiring debates and considerations emerged from the panel discussion and Q&A, mostly highlighting the importance of an effective research-to-innovation transition and the subsequent industrialisation and commercialisation of novel technology. Also, it was remarked the great potential of graphene and 2D materials-based innovations to be a disruptive and changing technology in fields such as energy storage, semiconductor industry, membranes, electronics, construction and photonics.

Being hosted as part of the Graphene Week conference, this international workshop gave the speakers the chance to network and discuss with many research organisations and companies active in the field of graphene and related materials in Europe and overseas, providing valuable opportunities for the initiation of new collaborative exchanges.

Both the Graphene Flagship and the UAE partners confirmed their interest in continuing the collaboration in the upcoming Horizon Europe phase, and plans are already being envisaged to organise the 3rd EU-UAE international workshop in 2024, with Abu Dhabi being considered as a perspective venue.

[1] https://www.manchester.ac.uk/discover/news/manchesters-graphene-partnership-with-khalifa-university-aims-to-tackle-global-challenges/

[2] https://www.levidian.com/recent-press2/levidian-nanosystems-partners-with-zero-carbon-ventures-to-deploy-500-loop-decarbonisation-systems-to-the-uae

[3] https://graphene-flagship.eu/graphene/news/graphmatech-and-khalifa-university-s-ric2d-sign-mou-to-collaborate-in-advanced-graphene-engineered-materials-and-manufacturing-processes/

Programme

Venue: Svenska Mässan, Innovation Alcove, Gothenburg (Sweden)

Indicated time corresponds to the Central European Summer Time (CEST) zone (Paris, Brussels time)

11:00 – 11:15	**Welcome Coffee**	
11:15 – 11:25	*Kari Hjelt*	Opening Remarks
11:25 – 11:35	*Hassan Arafat*	The Research and Innovation Center for Graphene and 2D Materials (RIC2D) at Khalifa University
11:35 – 12:15	**Graphene Flagship Industry Partners presentations**	
11:35-11:45	*Mamoun Taher*	Innovating with Graphene: Graphmatech's Solutions for a Cleaner and Diversified Future
11:45-11:55	*Burcu Saner Okan*	Sustainable graphene manufacturing from waste tires and its composite applications
11:55-12:05	*Vincent Bouchiat*	Industrial Scale-up of Graphene sensors with RFID & smartphone readout
12:05-12:15	*Guy Downie*	Graphene at the cutting edge of decarbonisation
12:15 – 12:35	**Graphene Flagship Business Developers presentations**	
12:15-12:25	*Ali Shaygan Nia*	Coatings and composites
12:25-12:35	*Piero Gamarra*	Energy generation and storage
12:35 – 13:15	**United Arab Emirates Partners presentations**	
12:35-12:50	*Monserrat Gutierrez*	Nanomaterials and the Industry in the UAE
12:50-13:05	*Abdelqader Abusafieh*	Enabling Success with Advanced Materials Innovations
13:05 – 13:40	**Panel Discussion & Q&A**	
	Kari Hjelt, Hassan Arafat, Ammar Jarrar, Abdelqader Abusafieh, Monserrat Gutierrez, Ian Kinloch	
13:40 – 13:50	*Fahad Alabsi*	Closing remarks
13:50 – 14:30	**Networking lunch**	

List of speakers

Name	Institution	Country
Hassan Arafat	RIC2D, Khalifa University	United Arab Emirates
Kari Hjelt	Chalmers Industriteknik	Sweden
Fahad Alabsi	RIC2D, Khalifa University	United Arab Emirates
Burcu Saner Okan	Nanografen Nanotechnological Products Co., Sabanci University	Turkey
Mamoun Taher	Graphmatech	Sweden
Vincent Bouchiat	Grapheal	France
Monserrat Gutierrez	Technology Innovation Institute	United Arab Emirates
Guy Downie	Levidian	United Kingdom
Abdelqader Abusafieh	STRATA	United Arab Emirates
Ammar Jarrar	RIC2D, Khalifa University	United Arab Emirates
Ali Shaygan Nia	Technische Universität Dresden	Germany
Piero Gamarra	Italian Institute of Technology	Italy
Ian Kinloch	University of Manchester	United Kingdom

BOOK OF ABSTRACTS

2nd Graphene Flagship United Arab Emirates - EU Workshop on Graphene and related 2D materials

Title: The Research and Innovation Center for Graphene and 2D Materials (RIC2D) at Khalifa University

First and last name: Hassan A. Arafat

Affiliation: Senior Director, Research and Innovation Center for Graphene and 2D Materials (RIC2D)
Khalifa University
PO Box 54224, Abu Dhabi
United Arab Emirates
Office: +(971) 2 810 9119
Email: hassan.arafat@ku.ac.ae
Websites: www.ku.ac.ae/pages/prof-hassan-arafat- www.sustainable-desalination.net

Short Biography:
Prof. Arafat is the Senior Director, Research and Innovation Center for Graphene and 2D Materials (RIC2D) and professor of chemical engineering at Khalifa University in Abu Dhabi, UAE, where he has been working since 2010. He received a Ph.D. and BSc. in Chemical Engineering from the Univ. of Cincinnati (USA) (2000) and the Univ. of Jordan (1996), respectively. He is a recipient of several research fellowships by the US National Academy of Science (USA), the Open Society Foundation (USA) and DAAD (Germany). Through his career thus far, he has supervised 58 postdoctoral fellows and graduate students. His research has been published in 270+ book chapters, journal papers, and conference presentations, in addition to two US patents. He has been invited and delivered more than 60 keynote and invited talks worldwide.

Abstract:
The United Arab Emirates is a young and diverse country, which is advancing at a rapid pace in all areas, most notably infrastructure, water treatment and desalination, healthcare, and energy amongst others. The emphasis is on sustainable, low emissions development, driven by high R&D investment.
The Research and Innovation Center for Graphene and 2D materials (RIC2D) is the result of the country's early acknowledgment of the potential of those technologies and the association with the Graphene Engineering Innovation Centre (GEIC) of the Univ. of Manchester from its inception stage.
With a dual focus on both research and commercialisation, RIC2D provides funding and support for collaborative research at an international level, as well as prototypes and products development jointly with industry. Priority 2D technologies areas are water, energy (including hydrogen) and lightweight materials. The Center is also pursuing interests in healthcare, photonics, and communications. Believing in the power of synergy and collaboration, we welcome all proposals for joint, impactful research and development with the aim of tangible, commercially viable outcomes.

Figure 2: Main campus, Khalifa University, Abu Dhabi, UAE

2nd Graphene Flagship United Arab Emirates - EU Workshop on Graphene and related 2D materials

Title: Industrial Scale-up of Graphene sensors with RFID & smartphone readout

First and last name: Prof. Vincent BOUCHIAT

Affiliation: Grapheal, Grenoble, France.

Short Biography: Vincent Bouchiat is the Founder and CEO of Grapheal, a company spin-off from Neel Institute focusing on bioelectronics and healthcare applications of monolayer graphene. He is on leave from the French National Research Center (CNRS) at Grenoble, where he has a permanent position since 1997. He co-authored more than 110 publications in electron transport in nanodevices with over 7,000 citations and hold 9 international patents. He received the Visiting Miller Professorship Award from University of California, Berkeley in 2007, and the Lee Hsun Research Award from the Chinese Academy of Sciences (2017).

Abstract:

At Grapheal, we are exploring the industrial use of graphene on biocompatible polymer[1,2] to enable simultaneous biosensing[3] and tissue engineering[4] together with the integration of an RFID component to enable direct connectivity with a smartphone. I will demonstrate our progress in integrating graphene biosensing devices into various consumer applications for on-site diagnostics as well as wearable sensors[5].

[1] A. Bourrier et al. Adv. Health. Mat. 8 , 1801331, (2019) doi : 10.1002/adhm.201801331
[2] F. Veliev, et al., Biomaterials, Elsevier, 86, pp.33–41 (2016).
[3] F. Veliev et al. Doi : 10.3389/fnins.2017.00466 (2017)
[4] Le Gall et al. doi: 10.1101/2021.05.16.444337 (2021)
[5] https://www.grapheal.com

Figure 1: Digital test strip based on the TestNpass platform from Grapheal

2nd Graphene Flagship United Arab Emirates - EU Workshop on Graphene and related 2D materials

Title: "Innovating with Graphene: Graphmatech's Solutions for a Cleaner and Diversified Future"

First and last name: Dr. Mamoun Taher
Affiliation: Graphmatech AB

Short Biography:
Mamoun is a distinguished deep tech entrepreneur and award-winning founder, currently serving as the CEO and CTO of Graphmatech in Sweden. He leads a passionate and high-performing team, leveraging the power of graphene to enable and accelerate the green transition. Mamoun is driven by a passion for solving complicated challenges through innovation and leadership and converting technical breakthroughs into commercial values.

Abstract:
Graphmatech, a Swedish start-up established in 2017 as a spinoff from Uppsala University, is at the forefront of the advanced materials industry, harnessing the transformative power of graphene technology. With a robust technology platform, the company is redefining possibilities in various sectors by offering specialized materials and cutting-edge solutions that are integral to the global green energy transition.
In a world driven by the urgent need for sustainable solutions, Graphmatech's focus on graphene-enhanced materials has positioned it as a player in the evolution towards cleaner energy sources. The company's innovative products span diverse applications including polymer-graphene materials for hydrogen transport and storage, materials tailored for 3D printing and high-precision industries, as well as graphene technology tailored for battery advancements.
By leveraging advanced graphene materials and modern manufacturing processes, the company works on contributing to the reduction of carbon footprints across industries. These groundbreaking materials not only enhance the efficiency of hydrogen transport and storage but also offer novel opportunities in high-precision manufacturing and additive printing processes, thereby revolutionizing the landscape of sustainable production. The United Arab Emirates (UAE) emerges as a focal point for deep tech solutions adoption. The UAE's commitment to sustainable development and its drive to diversify its economy align seamlessly with the transformative potential of graphene-enhanced solutions. Graphmatech recognizes the immense opportunities presented by the UAE's vision and aims to collaborate closely with local stakeholders through the research and innovation center for graphene and 2D materials (RIC-2D).
In this talk, we will delve into Graphmatech's journey from academia to a pioneering graphene technology force, highlighting its graphene-enabled breakthroughs that are instrumental in propelling the green energy transition. We will explore the diverse applications of the company's offerings, shedding light on the contributions to hydrogen transportation, precision manufacturing, 3D printing, and battery technology. Furthermore, we will underscore the strategic alignment between Graphmatech's innovations and the UAE's sustainability ambitions, showcasing how collaboration can accelerate the adoption of graphene-enhanced solutions and foster a cleaner, more resilient future.

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Title: Nanomaterials and the Industry in the UAE

First and last name: Monserrat Gutierrez

Affiliation: Technology Innovation Institute (TII)

Short Biography:

Director of Self-healing and Nanomaterials (TII)

PhD in Materials Science – Ecole Centrale de Lyon

Abstract:

the Technology Innovation Institute (TII) is a research institute based in Abu Dhabi, United Arab Emirates. It's a part of the Advanced Technology Research Council (ATRC), which is responsible for defining the strategy and overseeing the execution of R&D in the emirate of Abu Dhabi.

The TII is dedicated to driving advanced research and technology innovation in the UAE and aims to become a global leader in applied research and advanced technology. The institute's objective is to bridge the gap between early-stage academic research and the successful commercialization of viable products.

At the Technology Innovation Institute's Advanced Materials Research Center, one of its specialized research divisions, there is an ongoing expansion of research and development in nanotechnology within the UAE. This growth is fueled by investments across various sectors including renewable energy, advanced materials, water treatment, and healthcare. The integration of nanomaterials is playing a significant role in fulfilling the UAE's objectives of economic diversification, endorsing sustainability, and establishing the nation as a worldwide frontrunner in the realm of advanced technology.

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Title: Enabling Success with Advanced Materials Innovations

First and last name: Dr. Abdelqader Abusafieh

Affiliation: SVP Technology & Advanced Materials/Strata Manufacturing/Mubadala UAE Clusters

Short Biography:

Dr. Abusafieh is responsible for advanced materials business at Strata Manufacturing and R&D initiatives within UAE Clusters division of Mubadala. Dr. Abusafieh has over 25 years of industry experience in advanced materials & technology development across multiple industry sectors. His current role also involves supporting investment decisions in emerging technologies relevant to Mubadala Clusters' growth strategy. His prior US employment includes Drexel University, Composite Optics Inc., Alliant Techsystems (ATK), Cytec, and Solvay. He has co-authored several patents and sits on several management & advisory boards. He led execution of several R&D-sponsored programs from NASA, ARFL, and other government agencies in the US and received various awards.

Abstract:

Advanced materials continue to be a powerful tool for enabling advancement in various applications across many industries including mobility, healthcare, energy, computation & communications. The emergence of 2-D materials such as graphene's and MXenes in recent years have introduced a new generation of solutions with enhanced performance. This presentation will provide examples of how advanced materials have been used to enable success in various applications and highlight future opportunities with specific eye on UAE's recent initiatives in this domain.

2nd Graphene Flagship United Arab Emirates - EU Workshop on Graphene and related 2D materials

Title: Sustainable graphene manufacturing from waste tires and its composite applications

First and last name: Burcu Saner Okan

Affiliation: Nanografen Nanotechnological Products Co., Istanbul, Turkey, Sabanci University Integrated Manufacturing Technologies Research and Application Center & Composite Technologies Center of Excellence, Istanbul, Turkey

Short Biography:

Assoc. Prof. Dr. Burcu Saner Okan received BS degree in Chemistry at Middle East Technical University, Turkey in 2005. Dr. Saner Okan received MS degree in 2007 and PhD degree in 2011 in Materials Science and Engineering programme at Sabanci University. Dr. Saner Okan is an academic director of Sabancı University Composite Research Center since March 2022, and also a research faculty member at Materials Science and Nanoenginnering and Manufacturing technologies at Sabanci University since 2017. In addition, Dr. Saner Okan is co-founder of NANOGRAFEN Nano Technological Products Company. Dr. Saner Okan develops cost-effective and lightweight automotive composites parts reinforced by waste tire-derived Graphene NanoPlatelet with part producers and leading OEM partners. Dr. Saner Okan has an expertise in graphene, polymer nanocomposites, compounding, surface chemistry and electrospinning, recycling and upcycling, circular economy. She has more than 50 articles published in international journals, 8 book chapters, 2 patents and more than 50 conference papers in these fields.

Abstract:

Upcycling is a significant concept to bring an end to the life cycle of materials and open various new application routes for nanomaterial production from waste sources. Nanografen provides an insight into the importance of sustainable graphene synthesis methods and aims to reduce the amount of waste being sent to the landfills by developing upcycling approaches of thermoset wastes like tires. When tires are landfilled and just sit under air, they release methane gas into the air, release chemicals to the water and ground and thus alter the ecosystem. Nanografen developed a scalable technology to produce graphene nanoplatelets (GNP) from recovered carbon black obtained from the pyrolysis of end-of-life tires by using recycling and upcycling technology. Nanografen becomes an official supplier of Renault together with Ravago and they developed OEM certified masterbatch to reduce glass fiber and mineral amount in polypropylene and polyamide based interior and exterior parts. The presence of surface oxygen groups directly coming from manufacturing process hinder graphene agglomeration in compounding process and also it acts as a nucleating, compatibilizing and co-reinforcing agent in the thermoplastic matrix and thus keep the mechanical integrity even decreasing main reinforcement in the matrix. Consequently, this technology initiates the mass production by lowering cost from raw material to the selected part and overcomes the needs by addressing greenhouse gas emissions with sustainable designs by integrated manufacturing technologies of injection, overmoulding, and joining techniques.

To conclude, Nanografen's novel and sustainable solution supporting by applying eco-efficient manufacturing technologies and using Life Cycle Assessment provides CO_2 emission reduction of at least 10% in each application by adopting eco-design and a circular economy approach.

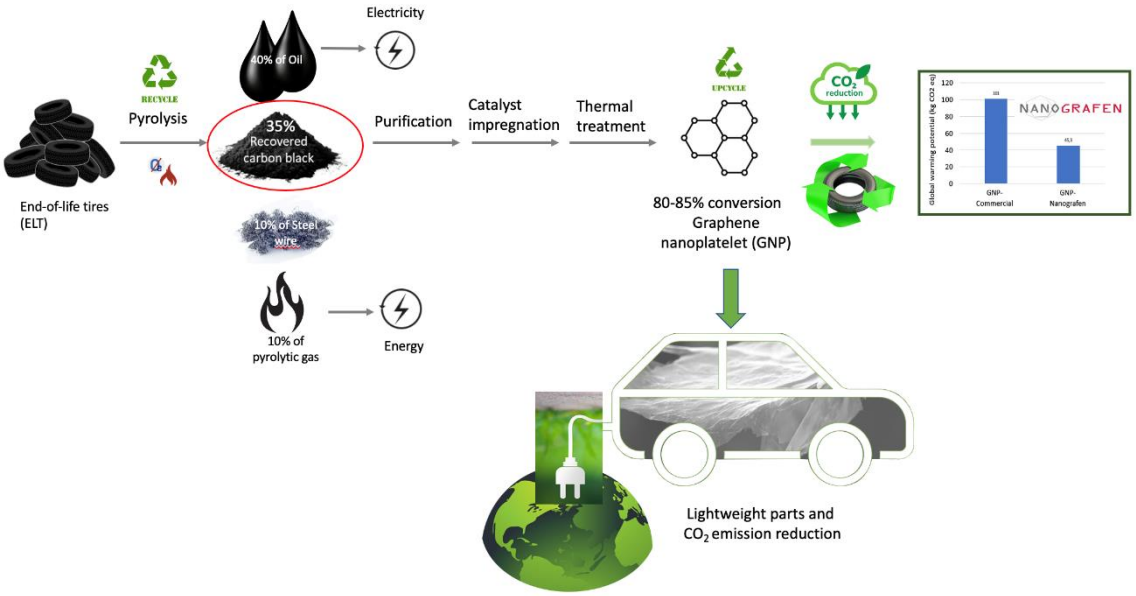

Figure 1: Nanografen's sustainable technology

2nd Graphene Flagship United Arab Emirates - EU Workshop on Graphene and related 2D materials

Title: Graphene at the cutting edge of decarbonisation

First and last name: Guy Downie

Affiliation: Levidian, Director – Sales and Business Development

Short Biography:

Guy has spent over 20 years in highly technical sales environments developing bespoke solutions in naval defence, subsea, oil & gas, renewables, and industrial markets. A degree-qualified chemical and process engineer, he began his career as a Graduate with Continental AG in the tyre industry, developing expertise in rubber and plastics. Guy subsequently moved into advanced composites and engineered materials, and later in specialised gas equipment systems with Trelleborg AB.
Guy has significant experience in North America, the Middle East, and Southeast Asia in both direct sales and growth of partner networks for sales and distribution. He joined the Levidian team in 2021 and leads their graphene team where they develop performance enabled materials to help reach NetZero.

Abstract:

Graphene has a wide range of applications that will directly contribute to the decarbonisation of heavy industries like concrete and the enhancement of new energy infrastructure like batteries, amongst other use cases. Levidian's proprietary production system, LOOP, produces graphene through the decarbonisation of methane. LOOP is a form of permanent carbon capture, producing a unique carbon negative graphene, with very few defects and a low CO2 footprint. Levidian's first LOOP was deployed remotely at Khalifa University in the UAE in 2022 where it successfully decarbonised methane and produced a high quality graphene called G3. Levidian has been focused on the development of graphene applications for infrastructure and other advanced materials such as concrete, mortars, paints and coatings, composites and more. Graphene can be used to increase material performance in mechanical, thermal, and electrical properties. In partnership with organisations across the UAE, Levidian is actively exploring routes to commercialise graphene applications that will decarbonise our world.