

The Roadmap to Applications of Graphene & Related Materials in UAE

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A priority area of Abu Dhabi's economic vision 2030 is Infrastructure Development and Environment Sustainability for robust economic development [1]. This aligns with the strategic UAE initiative to achieve net zero GHG emissions by 2050 [2]. Currently, the value of ongoing infrastructure development projects in the UAE stands at ~\$90 billion, which is considerably higher than most of the developed nations when compared per capita [3]. A substantial part of these projects includes Research & Development (R&D). The per capita R&D spending of UAE is among the highest in the world [4]. Some of the prominent priority sectors for future development in the UAE are Renewable & Clean Energy, Transportation, healthcare, water, and space, among others [1]. The Research & Innovation Center for Graphene and 2D Materials (RIC-2D) is complementing Abu Dhabi's vision of transforming into a knowledge-based economy by spearheading research and commercialization projects on graphene and related materials (GRMs). Unique and combination of properties of GRMs could make them key enablers for most if not all aspects of the current application areas of interest in the UAE as broadly mentioned before [5]. RIC-2D has started low (<3) and high TRL (>5) research in four thematic areas: 1) Water, 2) Energy, 3) Lightweight materials and 4) construction. Research work on these thematic areas is being conducted locally and with a network of global institutions among which University of Manchester is a key partner. Application of 2D materials for water are currently focused on desalination and water purification by incorporating 2D materials as selective sensors, membrane additives, active anti-fouling agents, and as corrosion protective coatings among others. Other innovative ideas with GRMs which are also explored include atmospheric water generation [6] and cloud seeding [7]. Green and blue hydrogen generation technology is being developed under the energy thematic area, in addition to other energy storage and generation technologies. For example, UAE is one of the largest sulphur producers in the world [8]. Therefore, it is appealing to build technologies around GRM for sulphur-based batteries. Similarly, applications of GRM-enhanced, stronger, lighter, and smart composite materials and concrete are research areas currently pursued in UAE. Additionally, RIC-2D will eventually also explore the application of 2D materials in quantum information system and products, which cannot be obtained with current materials technologies.

References

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