Exploring the Potential of 2D-based Nano/Microswimmers for Biomedical and Environmental Applications

Bahareh Khezri,[1,2] Lukas Dekanovsky,[3] Seyyed Mohsen Beladi-Mousavi[3]

[1]Institut Català d'Investigació Química, Avinguda dels Països Catalans, 16, 43007 Tarragona
[2]Departament de Química Física i Inorgànica, Universitat Rovira i Virgili, Marcel.lí Domingo 1, Tarragona, E-43007, Spain
[3]Department of Inorganic Chemistry, Faculty of Chemical Technology, University of Chemistry and Technology Prague, Technická 5, 166 28 Prague 6, Czech Republic Email: khezrib@vscht.cz, bahareh.khezri.research@gmail.com

Abstract

Nano/microswimmers with autonomous motion are the frontier of nanotechnology and nanomaterial research. These self-propelled nano/microswimmers convert chemical energy obtained from their surroundings to propulsion. Particularly, the recent progress in targeted drug delivery and efficient water purification systems is very promising. Graphene and the recently discovered layered materials -beyond graphene- have superior properties and have made a great impact on the new generation of energy, biomedical and environmental applications. Integration of single/few layers materials with extremely high surface area into nano/microswimmers has been created a dynamic platform which could significantly enhance motor's functions in terms of adsorption capacity and mobility. We have employed 2D-based microswimmers to demonstrate (i) organics / heavy metals / ions collection and DOX loading, (ii) a targeted transport system, (iii) the on-demand release mechanism, and (iv) the recovery of the robots for further usage.[1-13]

References

[1] Lukas Dekanovsky, Yulong Ying, Zdenek Sofer, Bahareh Khezri* Small Methods (2023) Accepted.
[2] Huaijuan Zhou; Bing Wu; Lukas Dekanovsky; Shuangying Wei; Bahareh Khezri; Tomas Hartman; Jinhua Li; Zdenek Sofer, FlatChem, 30 (2021) 2452 – 2627, 2021.
[3] Lukas Dekanovsky; Bahareh Khezri*; Zdeňka Rottnerova; Filip Novotny; Jan Plutnar; Martin Pumera, Nature Machine Intelligence. 2 – 11 (2020) 711 – 718.
[4] Bahareh Khezri; Katherine Villa; Filip Novotný; Zdeněk Sofer; Martin Pumera, Small (2020) 16, 2002111.
[5] Bahareh Khezri; Filip Novotný; James Guo Sheng Moo; Muhammad Zafir Mohamad Nasir; Martin Pumera, Small 16 (2020) 2000413.
[6] Seyyed Mohsen Beladi-Mousavi; Jonas Klein; Bahareh Khezri; Lorenz Walder. ACS Nano. 14 - 3 (2020), 3434 – 3441.
[7] 2019
[8] Seyyed Mohsen Beladi-Mousavi; Bahareh Khezri, Ludmila Krejčová; Zbyněk Heger; Zdeněk Sofer; Adrian C. Fisher; Martin Pumera, ACS Applied Materials and Interfaces 11, 14 (2019) 13359 – 13369.
[9] Bahareh Khezri; Martin Pumera. Metal–Organic Frameworks Based Nano/Micro/Millimeter-Sized Self-Propelled Autonomous Machines. Advanced Materials 31 (2019) 1806530,
[10] Tijana Maric; Seyyed Mohsen Beladi-Mousavi; Bahareh Khezri; Jiri Sturala; Muhammad Zafir Mohamad Nasir; Richard D. Webster; Martin Pumera. Small (2019) 202000413.
[11] Seyyed Mohsen Beladi-Mousavi; Bahareh Khezri; Stanislava Matějková; Zdeněk Sofer; Martin Pumera. Angewandte Chemie International Edition 131, 38 (2019) 13474 – 13478.
[12] Bahareh Khezri; Seyyed Mohsen Beladi Mousavi; Zdeněk Sofer; Martin Pumera. Nanoscale 11, 18 (2019), 8825 – 8834.
[13] Bahareh Khezri; Seyyed Mohsen Beladi Mousavi; Ludmila Krejčová; Zbyněk Heger; Zdeněk Sofer; Martin Pumera. Advanced Functional Materials. 29 (2018) 1806696.