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Editorial

Emerging Low-Dimensional Materials (Volume I)

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1. Introduction

We recently published the first volume of the Special Issue "Emerging Low-Dimensional Materials". Impressively, we have a great collection of 11 outstanding articles that have been published. You are welcome to access these articles without any charge via the following link: https://www.mdpi.com/journal/crystals/special_issues/Emerging_Low_Dimens_Materials (accessed on 30 December 2022).

In this Special Issue, Jianping Long and coworkers report high-performance nickel-phosphide-based hybrids prepared in one step used as supercapacitor electrodes without a polymer binder [1]. They showed good electrochemical performance due to their good catalytic activity, excellent conductivity, increased catalytic active sites, and improved ion transmission caused by the interface effect.

MXenes, as emerging 2D materials, have been widely applied in various fields due to their unique properties. A review article focusing on MXene-based materials used as electrodes for flexible supercapacitors has been timely summarized by Zhu's group [2]. The recent progress in fabrication methods of MXene-based flexible electrodes, their corresponding electrochemical performance, and future possibilities are discussed in detail.

Besides supercapacitors, there are two research articles focusing on anodes for Li/Na-ion batteries. Zhai and her coworkers designed cerium-doped cobalt phosphide@nitrogen-doped carbon (Ce-doped CoP@NC), which possesses a hollow polyhedron architecture, using Zeolitic Imidazolate Framework 67 as a template [3]. The Ce-doped CoP@NC exhibited excellent electrochemical performance as an anode in Li-ion batteries due to Ce doping's structural merits, the carbon network, and the well-designed hollow polyhedron.

Wu et al. successfully synthesized a sodium–tin alloy anode, which was in situ electrochemically formed via a straightforward design of Sn foil integrated with a Na ring [4]. The fluffy, porous structure of a Na–Sn alloy anode can effectively alleviate the change in the volume of Sn metal during cycling, and can also inhibit the formation of sodium dendrites. More importantly, the consumption of Na ions due to the repeated formation of SEI film can be instantaneously complemented, thus increasing the Coulombic efficiency.

For hydrogen/oxygen evolution, Chen et al. designed $Ni(OH)_2$/nickel-foam-based electrocatalysts with a tiny amount of ferrocene formic acid (FFA) (FFA-$Ni(OH)_2$/NF) via electrochemical activation and surface atom modulation [5]. FFA-$Ni(OH)_2$/NF exhibited outstanding OER performances in an alkaline solution, benefiting from the synergistic effects of Fe-Ni heteroatoms and the strong electron interaction.

Regarding improving electrocatalytic performances for hydrogen evolution reactions, Hongyu Wu and coworkers fabricated 3D FeP-Pt film on carbon cloth (3D FeP-Pt/CC) using hydrothermal methods together with phosphating as well as electro-deposition [6]. Three-dimensional FeP-Pt/CC demonstrated superior electrocatalytic performances for hydrogen evolution reactions at all pHs, with excellent long-term stability and remarkable durability.

Zhongren Nan's group at Lanzhou University prepared three-dimensional urchin-like MnO_2@poly (sodium 4-styrene sulfonate) (PSS)/poly (diallyl dimethylammonium

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chloride) (PDDA)/PSS particles (MnO_2@PSS/PDDA/PSS) through the layer-by-layer assembly strategy [7]. MnO_2@PSS/PDDA/PSS demonstrated high efficiency in removing Zn^{2+} from an aqueous solution at a pH of 13. Moreover, it was effective in removing Pb^{2+} and Cu^{2+} from slightly alkaline water.

Qiong Shang's group synthesized unique titanium dioxide nanotube (TiO_2NTs)-coated fiber through the anodization of Ti wire in the electrolyte [8]. Moreover, the extraction mechanism of polycyclic aromatic hydrocarbons by TiO_2NT fibers was explained in detail.

Hyunwook Song's group studied a molecular junction with two graphene contacts incorporated with self-assembled arylalkane monolayers [9]. Their results demonstrated reliable and stable molecular junctions with graphene contacts as well as intrinsic charge transport characteristics. Meanwhile, the potential application of the voltage-induced barrier-lowering approximation to the graphene-based molecular junction was justified.

Based on their last work, Hyunwook Song and coworkers further fabricated vertical molecular tunneling junctions with graphene heterostructures, where arylalkane molecules can act as charge transport barriers [10]. Various characterization techniques and an intact statistical analysis were adopted in this research.

Another paper related to molecular junctions is reported by Seo et al. [11]. The high-temperature electronic transport activities of spin-coated PEDOT:PSS junctions based on self-assembled oligophenylene dithiol monolayers were investigated.

In conclusion, this Special Issue presents recent progress on emerging low-dimensional materials and could encourage future investigations into them.

After finishing the first volume successfully, we think that there is still plenty of room for research on low-dimensional materials. Therefore, we have decided to announce the second volume of this Special Issue on low-dimensional materials. You are welcome to submit any high-quality manuscripts related to low-dimensional materials to the second volume. Please find more details at the following link: https://www.mdpi.com/journal/crystals/special_issues/HN197LMB87 (accessed on 30 December 2022).

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