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The new photoelectric materials for analytical applications

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Abstract

Since it combines the benefits of both optical and electrochemical approaches, the photoelectrochemical technology has gained a lot of attention. It's been used to produce DNA sensors, cytosensing, enzyme analysis, immunoassays, and many other small molecules sensing systemsThe photoelectrochemical sensor's mechanism is based on the photoelectron's reductive property or the oxidative capacity of the photo-generated hole. However, effective and stable photocatalysts capable of capturing visible light are still required for optimal solar energy utilisation. In order to best facilitate the specific analytical system, in our group, through theoretical simulations with calculation of the binding energies, a variety of semiconductor and composite materials have been designed and optimized including silver halide series of composites (AgBr/g-C3N4/N-graphene, AgCl/Ag nanocrystles, Ag@AgCl/BiVO4, AgX/graphene aerogels, AgClxBr1-x, Ag@AgBr/SO3H-Graphene, etc.), series of doped & hybrid TiO2 composites (ug-C3N4/TiO2, GO/TiO2, SO3H-Graphene/ TiO2, Ce-S-TiO2/SO3H-graphene, polyaniline-graphene/TiO2, etc.) and other semiconductors (V-doped BiMoO4, Pd/SnO2/ graphene, etcIt demonstrates that such a photoelectrochemical technology is a good fit for water quality monitoring and purification, global antioxidant capacity assessment, o-diphenol discrimination, carbon dioxide reduction, and other uses. The photoelectrochemical technique is expected to provide fresh insights into the architectural design of innovative photocatalysts with high photoactivity, as well as new applications in the fields of environmental, food, and energy.

Organic photoelectric materials have been used in ionizing radiation detection for nearly hundred years. Until recently, the novel molecular design, progressive preparation technology and further mechanism exploration have once again greatly expanded their application field, as well as showing a short response time, low limitation of dose rate and high sensitivity, which can be used as candidate materials for next-generation high-energy radiation detectors owing to their low-cost processing techniques, flexible properties and promising low detection limit. This article explores contemporary research on X-ray and gamma ray detection based on organic thin films, single crystals, polymers, and liquid materials, based on a brief description of the detection mechanism. It focuses on the benefits of these materials, bottlenecks that have been encountered, and relatively effective solutions that have been implemented in recent years. This article aims to provide readers with a deeper understanding of the comprehensive approach to design organic materials and improve the conversion efficiency for future ionizing radiation detection.

Photoelectric devices have a number of advantages, including creating a current that is precisely proportional to light intensity and having a very fast response time. The photoelectric cell, often known as a photodiode, is a simple device. This was originally a phototube, a vacuum tube with a metal cathode with a tiny work function that allowed electrons to be easily emitted. An anode held at a large positive voltage compared to the cathode would collect the current produced by the plate. Phototubes have been phased out in favour of semiconductor-based photodiodes, which can detect light, quantify its intensity, operate other devices in response to illumination, and convert light to electrical energy. These devices operate at low voltages, similar to their bandgaps, and are utilised in a variety of applications including industrial process control, pollution monitoring, light detection in fibre optic telecommunications networks, solar cells, imaging, and many more.

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