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Editorial

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Preface: Forum on Conjugated Polymer Materials for Sensing and Biomedical Applications

This issue of *ACS Applied Materials & Interfaces* features a forum focused on the development of new conjugated polymer (CP) materials that are useful for sensing and biomedical applications. There is currently considerable interest in the development of new conjugated polymer materials and interfaces for use in highly sensitive sensing and biomedical applications because of their unique optoelectronic properties. Conjugated polymers are characterized by a delocalized electronic structure that exhibits very efficient coupling between optoelectronic segments. Excitations can be efficiently transferred to lower energy electron/energy acceptor sites over long distances leading to "fluorescence super-quenching" and optical signal amplification. These photoactive CP materials used as biosensing elements can sensitively detect specific chemical and biological targets. Very recently, advances in biological applications of conjugated polymers have focused on highly sensitive diagnostics of pathogenic bacteria and tumor cells and detection of disease-related biomarkers. Beyond sensing, conjugated polymer materials provide a new direction for biomedicine in the context of disease diagnosis, cell imaging, drug/gene delivery, disease treatment, and antibiotic applications. The work in this field is interdisciplinary, bringing together scientists and engineers working in fields such as chemistry, materials, physics, biology, and biomedical sciences, and has applications across a number of industries such as health, food, environment, and defense.

The objective of this forum is to provide the readership with a concise collection of articles in the area of conjugated polymer materials and interfaces relevant to sensing and biomedical applications. Each paper in the forum is authored by a leading group in this research area. The collection includes nine focused research articles that highlight the development of new conjugated polymer materials that are useful for sensing and biomedical applications. One paper describes the preparation of thermochromic inkjet-printed polydiacetylenes (PDAs) for temperature sensor and anticounterfeiting barcode applications. Three articles emphasize the design of colorimetric and fluorescent conjugated polymers for detections of heparin, surfactants, and rapid assessment of microbial contamination of water. One article details a facile synthetic strategy toward a conjugated polyelectrolyte with oligopeptide as pendents with excellent cell uptake and imaging abilities. Another article describes the design of polyfluorene containing pendent alkylating moieties for DNA alkylation and gene regulation in cells. Another article highlights the importance of interfaces in the control of protein absorption and cell adhesion using polymer-brush-grafted poly(3,4-ethylenedioxythiophene) films. An article and a letter describe the development of new approaches to imparting light-activated biocidal activity by using light-absorbing conjugated oligomers and polymers. In addition, the forum also contains a spotlight article and a review article.The spotlight article highlights recent work by the authors on calometric and fluorescent sensors based on polythiophene derivatives, placed within the context of relevant work by other groups in this area. The review article provides overviews of particular areas of conjugated polymer materials in amplifying sensory mechanisms, and provides a broad perspective on conjugated polymers for optical sensing applications.

In spite of the encouraging progress, limitations that prevent these conjugated polymer materials from use in practical applications and complicate further development still exist. To circumvent these limitations, the design and preparation of novel conjugated polymer materials are expected to be explored in the future. Taken together, the articles collected in the forum provide insight into the significant progress that is being made in the development of new conjugated polymer materials for sensing and biomedical applications, and the need for more research to meet future challenges.

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Notes

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