Synopsis of Original Research Paper

Ultra-sensitive sensing of cosmetic fragrances using peptide matrices

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In recent years, the development of ultra-sensitive sensing technology for volatile organic compounds (VOCs) has extended beyond environmental monitoring to encompass a wide range of applications including cosmetics and food quality inspection, body odor analysis, fatigue and stress marker detection, and hazardous substance detection. In response, there has been significant progress in the development of compact devices targeting various VOCs using semiconductor manufacturing technologies such as MEMS. However, existing VOC sensors like gas chromatography have been unable to meet the demands for real-time detection, miniaturization, and ultra-sensitivity. Therefore, this study aims to create an ultra-sensitive bioelectronics VOC sensor that meets inspection needs by integrating target recognition molecule design techniques with biosensing technology on two-dimensional atomic thin films. Initially, peptides binding to nonanal, a major component of cosmetic fragrances and a key contributor to aging odor, were explored. Functional materials capable of efficiently capturing nonanal were developed by modifying the surface of ZnO nanowire arrays with these peptides. Furthermore, graphene field-effect transistor (GFET) sensing using peptides binding to other aldehyde molecules identified previously, such as benzaldehyde, demonstrated ultra-sensitive VOC detection.