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Digitalization of smell: development of chemical sensors from lab to startup business

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Chemo-sensory system is an essential part of the living organism ranging from the smallest bacterial cells up to the most complex neural systems as presented in human. In fact, the sense of smell especially in mammalian species (i.e., dogs and human) occurs at the nanoscale. By transduction of the chemical interactions between the odor molecules with the receptor proteins into electrical signals, smell perception including recognition and memory would be possible. At present, nanoscience of smell attracts a great interest from both academic and industry, particularly in terms of artificial olfaction. Technological applications of artificial noses (aka electronic nose) are vast: for examples, quality assurance of foods, beverage and agricultural products, health-care diagnostics, environmental monitoring, security systems etc. In this lecture, the development of electronic nose from the discovery of sensing materials to the fabrication of chemical sensor array up to the integration into various forms of electronic nose systems, such as portable, handheld and wearable devices, will be presented. We have explored numerous sensor materials based on different sensing mechanism, i.e., metal oxides, porphyrins/phthalocyanines, carbon nanotubes and conductive polymers, in order to span the applications in broad areas. In addition, techniques of hybridization between the sensor materials as well as transduction principles have been examined, leading to enhanced functionality and flexibility of the new electronic nose systems. Especially in this lecture, real-world applications of our electronic noses to assess the quality of foods, diagnose cancer, determine the health status of individuals and monitor the environmental conditions will be demonstrated. Development of a startup business based on this research will be provided in this lecture.

Keywords: chemical sensor, electronic nose, smell, artificial sense

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