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FET ion sensor with nanometric lipid gate insulator for high sensitivity detection level

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The ability to detect ions/molecules of pathological or physiological interest in the body associated with high sensitivity and specificity offers large opportunities for the early diagnostic and treatment of diseases. For example, the case of the Wilson's disease, which is induced by the accumulation of copper in tissues, is one of these typical examples. When the disease is diagnosed early enough it can be efficiently treated otherwise it leads to death when the diagnostic is realized at a too advanced stage of the disease. Therefore, it is crucial to develop a test with unique features such as ease of use, fast and low cost allowing systematic early diagnostic. Our project stands in this framework. Our device is based on Field Effect Transistor (FET) technology and is constituted of an organic lipid monolayer with a thickness of 2.7 nm used as gate dielectric instead of classically used inorganic oxide. Using an ultra-thin dielectric increases the sensitivity of the sensor while allowing using low operating voltage. The specificity of the detection relies on specific chelators that are grafted to the lipids head-groups. Together, the lipid monolayer and the chelator constitute the active layer of the device and play a major role in the device's performance. We will show how the quality of the monolayer in terms of density and mechanical stability directly impacts its insulating properties and performances. Sensing examples regarding iron(III) and copper(II) detection are demonstrated with sensitivities down to the femtomolar range. These are among the best results reported for small ions detection.

Biography

Ahmad Kenaan is pursuing his PhD in Biophysics and Nanotechnologies at Aix-Marseille University, France. He has published one article during his Master's degree, two during his internship and he is working on at least three articles to be published at the end of his PhD. He has one patent and one submitted patent application to his credit.

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