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High on/off ratio on PEDOT:PSS-based OECT

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One of the most common polymers used as active material in organic electrochemical transistors (OECTs) is the PEDOT:PSS. This happens due to his high conductivity and stability in water. Being a depletion mode material, the transistor's current is controlled by the de-doping of the PEDOT:PSS channel, with ions from the electrolyte layer. That is, the device is initially in the on state and it is turned off by the diffusion of cations from the electrolyte. A ratio between the on and off currents can be used to quantize the efficiency of the de-doping. This is the on/off ratio of the transistor, and it is an important parameter to be analyzed when thinking in sensing applications. Common on/off ratios for PEDOT:PSS-based OECTs with aqueous electrolytes are in the order of 10^2 . (1) Here, we achieved a high on/off ratio of 10^5 using an ionic gel as electrolyte layer. The gel consists of PVA as the polymer matrix and [BMIM][HSO₄] as the ionic liquid. This record on/off ratio indicates a good de-doping of the PSS chains, which leads to a very low off current in the order of 10^{-8} A. While needing a more deep understanding of the de-doping mechanism, it probably comes from two effects. One is the low energy barrier for ions, due to the small phase difference between the solid channel and the semi-solid electrolyte. The other is the low leakage current due to the more resistive electrolyte. The use of ionic gel in PEDOT:PSS-based OECTs are a novelty and can pave the way for devices with higher on/off ratios.

Palavras-chave: Organic Electrochemical Transistors. On/off ratio. PEDOT:PSS.

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