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Abstract

Cell Counting in Silicon Nanosensor for CAR T-Cell Therapy Monitoring †

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Abstract: Silicon nanowire sensors have demonstrated outstanding utility in biosensing, especially for small biomolecules at extremely low concentrations. However, the sensor is less commonly applied in whole-cell monitoring, such as CAR T-cell counting during cancer treatment. The patient's T-cells are modified to express chimeric antigen receptors (CAR), targeting specific tumor cells in CAR T-cell treatment. Therefore, the CAR T-cell level in blood is an essential parameter when it comes to determining the immune system's reactivity to fight cancer cells. Although nanosensors are typically beneficial for early cancer diagnosis and detection, we want to expand their application and explore their usage in cancer treatment monitoring and development. Our previous works showed promising results of using nanosensors to find the most effective immunotherapy. In this work, we study the response of silicon nanowire field-effect transistors (SiNW FET) to the binding of CAR T-cells and discuss the benefits and limitations of the sensors in cell monitoring. The SiNW FETs fabricated in a top-down manner showed superior sensitivity to IgG antibodies sensing in our previous study. A peptide with a high affinity to the designed CAR T-cells immobilized on SiNW FETs to detect the cell binding. We observed distinguished signals following the number of cells binding to the sensing area. The results pave the way for using nanosensors in monitoring cancer treatment, yet they suggest some room for improvement.

Keywords: biosensor; silicon nanowire; immunotherapy; CAR T-cell

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