INFLUENCE OF NON-ADHERENT YEAST CELLS ON ELECTRICAL CHARACTERISTICS OF DIAMOND-BASED FIELD-EFFECT TRANSISTORS

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Abstract

Diamond thin films were used as the substrate to cultivate cells and as the bio-electronic sensor. Here we studied the influence of yeast cells (Saccharomyces cerevisiae) on the electrical characteristics onf nanocrystalline diamond-based solution-gated field effect transistor (SGFET). Two different culture solutions (sucrose and yeast peptone dextrose (YPD)) were used without or with yeast cells. The measurement principle of diamond-based SGFETs is based on the H-terminated active surface, which is very sensitive to environment (solution/cell-substrate interactions) and is directly responsible to formation of with subsurface p-type channel of the transistor. Two different cell culture solutions (sucrose and yeast peptone dextrose (YPD)) were used, with or without yeast cells.Any change of the solution or cell culture behavior is reflected in the electrical characteristics of SGFETs. This feature of diamond SGFETs is used for studying the cell-solution and cell-substrate interaction. The transfer characteristics of SGFETs showed a negative shift of the gate voltage to higher values for both cell solutions, i.e. sucrose and YPD with cells, by -26 mV and -42 mV, respectively, in comparison to blank solutions without cells. Possible reason of Tthis effect is attributed to the pH could be related to change in pH in a close vicinity of at the H-terminated diamond surface due to metabolic processes of the yeast cells. The pH sensitivity of the diamond SGFETs as well as the role of the negative surface charge of yeast cells on the experimental SGFETs electrical characteristics results are discussed.

Keywords: Nanocrystalline diamond, yeast cells, field-effect transistor, transfer characteristics, pH sensitivity

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