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Potentiality of polysilicon nanogap structure for label-free biomolecular detection

Abstract

Purpose - The purpose of this paper was to systematically study the electrical properties of 5-, 42- and 75-nm gap polysilicon structures to evaluate the potentiality of these structures to be used in biomolecular sensing devices. Design/methodology/approach - The authors previously reported the fabrication and morphological characterization of these structures. In this report, they electrically probed the presence of nanogap through current measurement. The effects of electrolytes on the capacitance profiles of these structures were systematically studied with air, water and various dilutions of phosphate buffer saline. Findings - An increment in capacitance was found with the increment in electrolyte concentration. Improvement in current flow, capacitance, permittivity, and conductivity were observed with the smaller size nanogaps, suggesting their applications in low power consuming devices. Originality/value – Since nanogap-based dielectric biosensing devices need to be operated with a low level of current to avoid biomolecular damage, these structures should have potential applications in dielectric-based biomolecular detection using a low cost dielectric analyser.

Keywords

Dielectric-based biomolecular detection; Double-layer capacitance; Nanogap electrodes; Sensors; Silicon