

Peer Review

Review of: "Negative Capacitance Effect at the Interface Between Si Wafers with Undulating Surfaces"

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An attractive title is not justified by the content of the paper. Neither experiment is done correctly, nor does the analysis provide a sound physical explanation of the indicated effect (negative capacitance).

First, a capacitor structure with a high leakage current density (low parallel resistance) is studied using measurements in serial mode (C_s - R_s), instead of parallel mode (C_p - R_p). That way, the reported extremely high values of capacitance (of about 50 nF), compared to the high-frequency values of about 350 pF, are only apparent values (equivalent serial capacitance) obtained by an inappropriate choice of the measurement mode.

Second, the reported negative values of capacitance correspond to the range of frequencies lower than 100 Hz, where the capacitance measurements are on the edge of accuracy. Namely, the basic accuracy of the phase angle of the measuring instrument (impedance analyzer, HIOKI, IM3570) is 0.05° i.e., 0.001 rad. Capacitive resistances (reactance), being as high or higher than 50 M Ω for frequencies as low as 10 Hz or lower, are 1000 times higher than the active resistances, which are of the order of 50 k Ω or lower, making questionable the accuracy of the results reporting negative capacitances. Another measurement method appropriate for low capacitances in the presence of high leakage is to be applied for measurements in the low-frequency range, at least for a few points, to obtain accurate results and to give a correct interpretation and solid confirmation of the presence of the indicated effect.

Although the explanation of the effect relies largely on the discussion of the resistance variability, no experimental results for the voltage/frequency dependence of the resistance are reported. In addition, the discussion is based on the dependence of the resistance on the bias voltage, while the dependence of capacitance on frequency is demonstrated and almost no dependence of the capacitance on the bias voltage.

Finally, if the indicated negative capacitance is realistic and not a measurement artefact, it is to explain what would be the interest in the creation of electron devices working on frequencies lower than 1 KHz?

Therefore, I do not recommend the publication of the considered paper.

Declarations

Potential competing interests: No potential competing interests to declare.