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Characteristics of MOSFET capacitors formed by deposition of ZrO_2:Y_2O_3 dielectric layers on Ge/Si(001) heterostructures grown by HW CVD

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In this article, we report for the first time on the volt-ampere characteristics and volt-farad characteristics of MOSFET capacitors formed by sequential deposition of thin layers of the gate dielectric ZrO_2:Y_2O_3 and Ti-Pd-Au of the gate electrode on Ge/Si(001) heteroepitaxial structures grown by the low-temperature method ($Ts = 350$ °C) by gas-phase deposition with pyrolysis of monogermane on a "hot wire" (Eng. Hot Wire Chemical Vapor Deposition (HW CVD)). The high structural perfection of Ge/Si(001) heterostructures (the dislocation density identified with the etching pit density was $\sim 1\times10^5$ cm^{-2}, and the high smoothness of the Ge layer surface ($rms = 0.37$ nm)) provided a prerequisite for the subsequent formation of MOSFETs. The use of thin layers of ZrO_2:Y_2O_3 with a 4 % Y_2O_3 content and additional annealing allows to reduce leakage currents to 5×10^{-5} A/cm^2 at $V = -1$ V. The density of surface states at the dielectric-semiconductor interface determined from the VFC of the MOSFET capacitor was 4×10^{12} $cm^{-2}eV^{-1}$, which opens up prospects for the use of such heterostructures in the manufacture of TIR transistors.

Keywords: MOSFET capacitor, Ge/Si(001), HW CVD.

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