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Dielectric Polarization 1/f Noise: a signature of defect-free oxides at nanotransistors interface NICOLAS CLEMENT, IEMN-CNRS (France), KATSUHIKO NISHIGUCHI, NTT Basic Research Labs (Japan), DOMINIQUE VUILLAUME, IEMN-CNRS (France), AKIRA FUJIWARA, NTT Basic Research Labs (Japan) — Low frequency 1/f noise has been a well-studied method for evaluation of materials quality for devices operation. The two main sources of 1/f noise have been identified as the mobility noise (Hooge's equation) related to defects in the channel and the trapping-detrapping noise (Mc Whorter equation) related to defects in oxide at semiconductor interface. Here we show that for a 0D nanotransistor (typically 15 nm diameter and 40 nm length), dielectric polarization 1/f noise is observed at room temperature when there is no defect at interface. Such noise, derived from the fluctuation-dissipation theorem and related to the imaginary part of the capacitance (fluctuation of dipoles in oxide), has been measured in capacitors but never reported in field-effect transistors due to its lower amplitude compared to trapping-detrapping noise inducing almost 1/f curve with only 2 active traps. Since in 0D transistors the Debye screening length is larger than devices dimensions at room temperature, trapping-detrapping noise amplitude is easily determined and distinguished from DP noise. Therefore, we believe that such noise is a non-invasive and direct method for claiming the absence of defects at semiconductor-oxide interface in nanodevices and probe the dynamics of dipoles in materials at nanoscale.

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