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THE LATERAL DISTRIBUTION OF THE EFFECTIVE CONTACT POTENTIAL DIFFERENCE OVER THE GATE AREA OF MOS STRUCTURES

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ABSTRACT

The lateral distribution of the effective contact potential difference (ECPD), often referred to as the work-function difference ϕ_{MS}, was determined experimentally for the first time over the gate area of a metal-oxide-semiconductor (MOS) structure. The photoelectric method for measuring ϕ_{MS} in MOS devices was modified to characterize the lateral distribution of ECPD. In square MOS gates, it is found that ϕ_{MS} values were highest in the center area of the gate, lower along the gate edges, and lowest at the gate corners. These results were confirmed by several independent photoelectric and electrical measurement methods. A model is proposed, in which the experimentally determined $\phi_{MS}(x,y)$ distributions, are attributed to mechanical stress distributions in MOS structures. Equations are derived allowing calculation of $\phi_{MS}(x,y)$ distributions for various structures. Results of these calculations remain in agreement with experimentally obtained distributions.