A New Quantitative Hydrogen-Based Model for Ultra-Thin Oxide Breakdown

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Abstract

A new quantitative hydrogen-based model for the degradation and breakdown of ultra-thin SiO_2 gates oxides is presented. The model is based on the quantum mechanical description of chemical reactions which involve protons and oxygen vacancies both at the Si-SiO_2 interface (suboxide bonds) and in the oxide bulk. Comparison with experiment shows that the values of the model parameters are compatible with recent first-principles calculations. The results of this work suggest much improved projection for ultra-thin oxide reliability as compared to what previously reported.