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International Conference on
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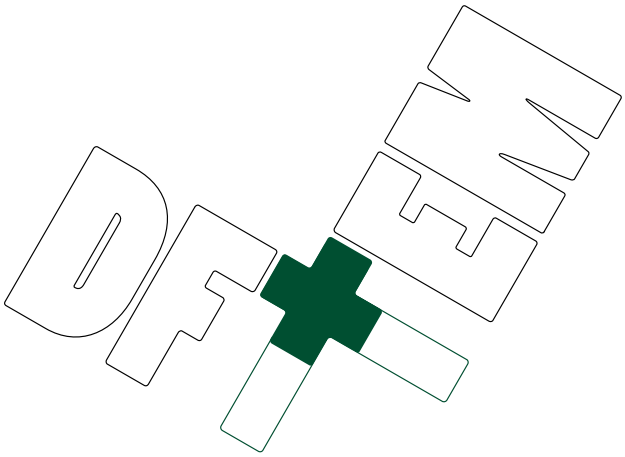
Vienna / Austria



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Analysis and Design of Materials-Processes for Future Transistors

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The ongoing miniaturization of semiconductor devices requires the replacement of the conventional SiO_2-based gate oxides by so-called high-k oxides, in order to avoid quantum mechanical leakage currents through an ultra-thin gate oxide. We discuss the route towards formation of epitaxial high-K oxides with silicon using state-of-the-art electronic structure calculations and ab-initio molecular dynamics simulations. I will describe the interesting interplay of metal atoms with the silicon dimers of the Si(001) surface, leading to sequence of phases as function of coverage. Then the interface structures between $SrTiO_3$ on silicon will be discussed. Special attention will be given on the interface chemistry and the requirements for obtaining an electronically inactive interface. We show that the band-offsets can be engineered for some of the interfaces by controlling the oxygen content at the interface. This is particularly important for the $SrTiO_3$/Si(001) interface, which otherwise suffers from unacceptably low injection barriers.

New developments in semiconductor technology aim at introducing new semiconductors into silicon technology. This requires growth of high-mobility semiconductors such as Ge onto buffer oxides such as $SrHfO_3$. Semiconductor growth on oxides suffers from clustering on the surface. We will show detailed studies of a potential process that shall allow epitaxial growth of Ge on $SrHfO_3$ using surfactants in molecular beam epitaxy.

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