DF 13: Applications of dielectric solids

Time: Wednesday 11:50–12:30 Location: GER 37

DF 13.1 Wed 11:50 GER 37

Why should one account for dielectric nonlinearities — •Martin Diestelhorst — Martin-Luther-Universität Halle, Wittenberg, Institut für Physik, Von-Danckelmann-Platz 3, 06120 Halle, diestelhorst@physik.uni-halle.de

Many applications of dielectrics assume the materials to be linear. That is often legitimated by confining the choice of parameters to ranges, for which that assumption is valid. However for some applications it is necessary to apply such high external fields, that one has to take into account deviations from the linear behaviour. On the one hand these nonlinearities may be harmful for some applications. Otherwise there could arise applications that may be realized only utilizing the nonlinear properties. Especially when using ferroelectric materials one has to be aware of the dielectric nonlinearities. We discuss implications for both cases of applications. As an example for the first case we consider the process of energy storage on a capacitor with ferroelectric material as dielectric, where the stored energy falls short of the amount extrapolated from small signal permittivities to high electric fields assuming linear behaviour. The second example is concerned with a parametric amplifier in a nonlinear series circuit with ferroelectric capacitor. The described effect is observable near period doubling bifurcations which may not be observed in linear circuits.

DF 13.2 Wed 12:10 GER 37

Ultra-thin Al_2O_3 passivation layers for solar cell applications — •Andreas Nägelein[1], Christian Koppka[1], Katja Tonisch[1], and Thomas Hannappel[1,2] — [1]TU Ilmenau, Institut für Physik, Fachgebiet Photovoltaik — [2]CiS Forschungsinstitut für Mikrosensorik und Photovoltaik, Erfurt

Thin Al_2O_3-layers have been shown to provide a high quality passivation on p-type surfaces. Especially for nanowire-solar cells surface-passivation plays a major role.
In order to investigate the quality of Al_2O_3 produced by atomic layer deposition (ALD) in an MOCVD reactor, p-type silicon (1-5 Ωcm) samples were coated on both sides with three different Al_2O_3 layer thicknesses (10 nm, 20 nm and 30 nm). UV/VIS measurements were done to determine the optical properties. XPS and FTIR investigations showed the composition of the layers. Passivation quality was proofed by QSSPC and MWPCD. Optical properties were measured by UV/VIS and obtained a transmission of more than 95% over a large wavelength range. QSSPC lifetime measurements showed a maximum lifetime of 388 μs at 30 nm Al_2O_3. After annealing 30 minutes at 400°C the lifetime increased to 1.25 ms. Comparable results are expected for nanowire applications.