TECHNISCHE UNIVERSITÄT DRESDEN

Faculty of Physics

PHYSICS COLLOQUIUM

Speaker:

Dr. Maximilian Lederer
Fraunhofer Institute for Photonic Microsystems,
Center Nanoelectronic Technologies,
Dresden

Topic:

Hafnium Oxide: A Game-Changer for Nanoelectronic Devices and Systems

Introduction for habilitation

Time and place:

Tuesday, November 28, 2023, **2:50 pm** – hybrid event
The colloquium will be held in REC/C213.
Online participation possible:
Zoom-Meeting: Meeting-ID: 631 3817 8900 / passcode: PC-WiSe23
https://tu-dresden.zoom-x.de/j/63138178900?pwd=am9nSzYyeUh3SWxMdnNBWkpUaXl5UT09

Host:

Prof. Lukas Eng

Abstract:

Electric devices, like transistors and memories, are omnipresent in modern society. With the downscaling of transistors to a few nanometers, following Moore's law, silicon oxide gate stacks reached their limitation in physical thickness due to tunnelling effects. Hafnium oxide, as a high-k dielectric, was found to circumvent this limitation and is used in the gate stacks of CMOS technology nodes smaller than 45 nm as well as DRAM technologies. These developments toward higher permittivity led to the discovery of ferroelectricity in hafnium oxide by Qimonda in Dresden 2008. Ferroelectric materials contain a permanent dipole in their ionic crystal structure that is switchable by applying an electric field. As these dipole states can be interpreted as a 0- or 1-bit state, ferroelectrics are highly interesting for the application in non-volatile memories.
This talk will provide an overview about recent developments in hafnium oxide technologies. On the one side, highly sophisticated HfO2-based memory devices have been demonstrated, even in highly scaled nodes. On the other hand, the unique properties of hafnium oxide lead to many new applications and research fields: Pyroelectric sensors, piezoelectric nanoelectromechanical systems, magnetoelectric spin-orbit devices, non-linear optics, neuromorphic devices and quantum computing.

Bio:

Maximilian Lederer is working as lead scientist for advanced nanoelectronic materials at Fraunhofer IPMS, Center Nanoelectronic Technologies. He studied material science and engineering at Friedrich-Alexander-Universität Erlangen-Nürnberg and received his master degree in 2018. In 2022, he received his Ph.D. degree in Physics from TU Dresden on the topic of ferroelectric hafnium oxide for non-volatile memories. Since 2019, he is working at Fraunhofer

IPMS and to date authored and co-authored more than 100 peer-reviewed journal and conference papers. Main research topics include materials compatible with CMOS processes, more specifically for ferroelectric devices, spintronic memories, quantum computing and photonics.