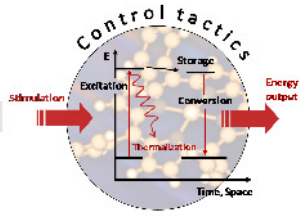

Aberration Corrected TEMs at the Ernst Ruska-Centre and their applications in Energy Science

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The introduction of aberration correctors has revolutionized the development of TEM and STEM instrumentation. In order to provide a platform for these novel developments and based on the experience with the first aberration corrected TEM, Research Centre Juelich and RWTH Aachen University have jointly founded the Ernst Ruska-Centre for Microscopy and Spectroscopy with Electrons (ER-C). Recently, the PICO instrument has been installed at the ER-C, which is the second high resolution TEM in the world with a corrector for the chromatic aberration.
Research at the Ernst Ruska-Centre focuses on the development of new quantitative methods in TEM and on their application in materials science and solid state physics. In the present contribution, two different examples for recent applications in energy science will be discussed: 1) The investigation of Si/SiO_2 multiple quantum wells for all silicon solar cells. In the Si/SiO_2 QW material the charge carrier confinement leads to an increase of the energy gap well above the bandgap value of bulk Si an ideal QW is predicted to have a theoretical efficiency limit of over 40 %. 2) The development of membrane materials for zero emission power plants. The subject of our studies is one of the most promising concepts for carbon dioxide capture and sequestration (CCS) which relies on the application of mixed ion and electron conducting (MIEC) ceramic membranes.