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Editorial

Special Issue: "From Surface Science to Nanoscale Devices"

As modern electronic devices miniaturize down to the nanometer range, the significance of surfaces and interfaces strongly increases with respect to the device functionality. Many of the state-of-the-art electronic semiconductor devices, i.e. high electron mobility transistors or resonant tunnelling diodes, are greatly determined by surface and interface properties in heterostructures. To a much larger extent, more visionary device concepts based on electron interference or spin-related effects depend on well-controlled interfaces with tailored potential profiles. Surface science provides the methods and concepts not only to characterize the structures but also to tailor the surface and interface properties during their making. In fact, the observed fast progress in the field of nanoscale devices would be unthinkable without the simultaneous progress in surface science. Here, beside the well-established methods, e.g. electron energy loss spectroscopy, scanning probe techniques have broadened the range of available methods considerably.

In the past two decades growth of epitaxial layer systems, e.g. by molecular beam epitaxy or metal-organic vapour phase epitaxy have been the working horses for the development of novel nanoscale devices. Currently the challenge regarding epitaxial growth lies in the fabrication of unconventional semiconductor heterostructures. With evermore shrinking sizes of microelectronic devices studies on mechanisms of self-assembly of nanopatterns and on the stability of nanopatterns have gained importance. A crucial aspect of these topics is the atomic transport at surfaces and interfaces. Effective control and the utilization of transport processes in nanopatterning require the understanding of all aspects of transport processes on the atomic level. Again, fast progress in the development of novel nanoscaled electronic devices is unthinkable without surface science.

This special issue aims at covering a range of topics between surface science and nanoscale device physics, which have been strongly influenced by Harald Ibach and Hans Lüth. The collection of 36 papers gives an extensive overview on recent achievements and future prospects in this field. In addition to a number of original papers on recent experimental and theoretical results in these fields, some review articles are also included. In the coming era of nanoelectronics, surface science and device physics will further fertilize each other and will help set the pace for further development.

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