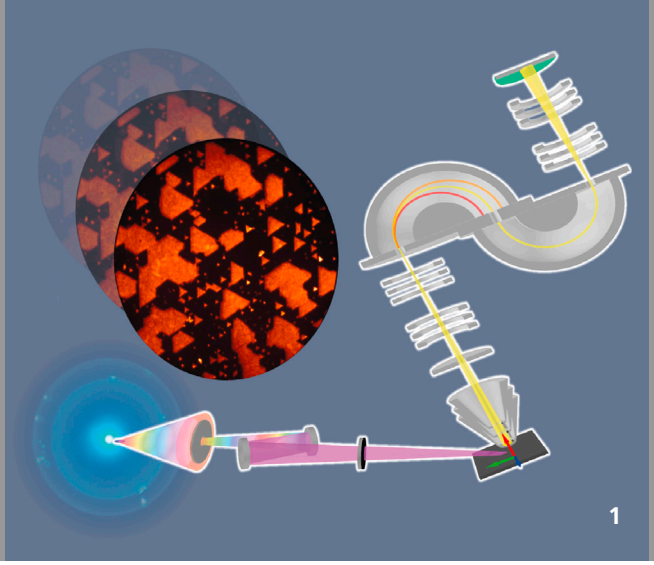
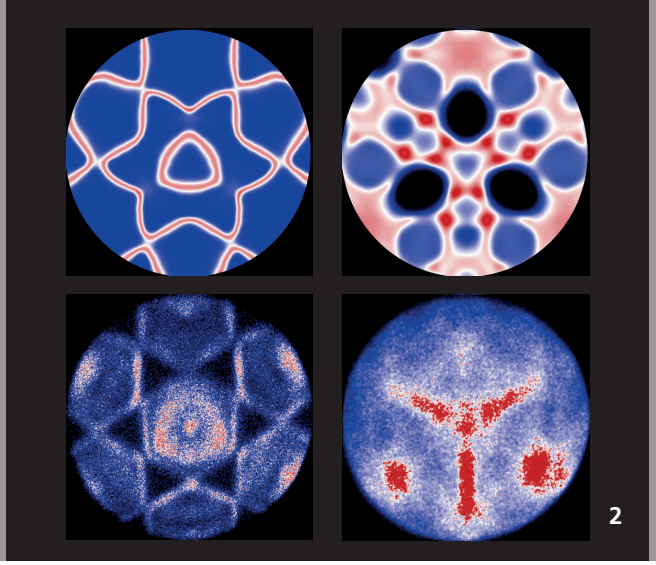


1



2

EUV PLASMA SOURCES FOR PHOTOELECTRON SPECTROSCOPY AND MICROSCOPY IN THE LABORATORY

Task

Since various academic and industrial disciplines have a growing interest in functional microstructures, there is an increasing demand for spatially resolved methods to characterize chemical and electronic properties in the micrometer range. So that the potential of the so-called spectro-microscopy can be fully exploited, radiation is used in the ultra-ultraviolet, up to the soft X-ray range. This type of sample characterization is normally carried out on electron storage rings (synchrotrons), but these large devices can only be used for a limited time on request. In the laboratory, there is an extreme spectral gap between helium I/II lamps (21 eV or 40 eV photon energy) and X-ray tubes (e.g. Al-kα ~ 1400 eV). The idea is, therefore, to use an EUV source covering the range of 40 to 600 eV by identifying all elements and by having the radiation per se exhibit a high cross-section of activity given by nature and a high surface sensitivity.

Method

In the first tests, the light from an EUV gas discharge source was spectrally filtered using multi-layer mirrors and focused on a sample within a FOCUS NanoESCA photoelectron microscope. The electrons released by the photoelectric effect are imaged and at the same time energetically filtered. The result is an image of the sample containing information on its chemical composition.

Results

In this project, Ge-Sb-Te (GST) islands were investigated. GST is a prototype material for processes based on a phase change of the material, widely known from rewritable optical media such as CD-RW or DVD-RW. It was possible to distinguish between oxidized and non-oxidized states of the material. Furthermore, it has been verified that images in the pulse space providing information on electronic properties can also be made with pinch plasma sources.

Applications

Photoelectron spectroscopy and microscopy are used in countless fields of application, e.g. in quality control.
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1 Experimental setup and recordings of Ge-Sb-Te (GST) islands with photoelectrons.
2 Comparison between simulated (above) and measured (below) ribbon structure of gold at two different electron energies.