The new end-station PEAXIS for RIXS and XPS measurements at the BESSY II synchrotron

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The electronic structure determines important functional material properties such as charge transport, which is related to the electronic band structure, and vibrational modes. Thus a profound understanding of the microscopic mechanisms underlying electrical conductivity and its coupling to thermal conductivity is gained by probing the electronic structure.

The new end-station PEAXIS built at the BESSY II synchrotron at Helmholtz-Zentrum Berlin combines two important experimental methods in one instrument: Angle-resolved Resonant Inelastic X-ray Scattering (RIXS) and X-ray Photoelectron Spectroscopy (ARPES) allowing band mapping of electronic states in a broad range of materials with a dedicated focus on solid state samples. PEAXIS extends the suite of RIXS instruments at the BESSY II facility towards high energy resolution providing a resolving power in the range of 10000.

The main feature of PEAXIS is the continuous variation of the scattering angle for RIXS measurements from 32° up to 149° without loss of vacuum. This permits changing the instrument settings for a measurement with a different wavevector within minutes. The angular variation corresponds to a maximal variation in momentum transfer by a factor of 3.5. The accessible photon energy range extends from 185 to 1200 eV. In addition, the hemispherical electron energy analyzer enables angle-resolved soft X-ray photoelectron spectroscopy over an even larger energy range. The analysis chamber offers solid-state sample manipulators covering a broad range of temperatures from 10 to 1000 K as well as a microfluidic-cell sample environment.

Here we present the development and the capabilities of the instrument as well as first measurements performed during the commissioning phase. We conclude with some ideas for future instrument upgrades.