Helium Atom Scattering from Oxide Surfaces

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Many experimental methods of surface science employ electrons or photons of considerable incident energy as probe particles. However, insulating surfaces or delicate physisorbed layers may be damaged by these particles and should, therefore, be analyzed with a gentler probe: He atom scattering allows to determine the symmetry of the unit cell and the detection of phase transitions from diffraction measurements as well as the determination of surface and adsorbate vibrations by time-of-flight resolved detection. In this article, the application of He atom scattering to oxide surfaces is demonstrated on the basis of the examples of MgO and ZnO. MgO(001) is a very inert and stable surface, whereas hydrogen atoms are chemisorbed on the mixed-terminated ZnO($10\bar{1}0$) and on both polar faces: ZnO($000\bar{1}$) and ZnO(0001). He atom scattering is very sensitive to the presence of hydrogen on surfaces. In addition ZnO reacts with molecules like water, CO and CO_2. It is demonstrated, that in combination with Photoelectron Spectroscopy and Thermal Desorption Spectroscopy, He atom scattering can also contribute to studies of surface chemistry.