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Low Energy Atom Scattering Spectroscopy for Insulator Surface Analysis: MgO(111) Surfaces

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Fundamental concepts for surface science are well-established and their applications are straightforward for metals and semiconductors, but not for insulators materials. Bombardment of insulator surfaces by charged particles such as electron or ion beams can be induced a charge on their surfaces. One can see the charging/discharging dynamics of the insulating material during this ion-beam bombardment. Sometimes, an electron shower using a tungsten filament placed nearby a sample is used to reduce the sample charging. However, electron-shower failure can cause sample damage. Therefore, we have developed a low-energy atom scattering spectroscopy system for the analysis of these insulator surfaces. The primary beams were 3 keV-4He neutral particles which were pulsed with 100 kHz by chopping plates. Actually, flight times were measured using MCP (micro channel plates) on this detection system. MgO is an exceptionally important material, which used in catalyst, toxic-waste remediation agent, or as an additive in refractory, paint as well as for fundamental and application studies. The 111 surface gives a hexagonal arrangement of atoms. We have obtained the image pictures which consists of Mg atoms and Oxygen atoms on outermost layers using this technique.