Approach for simultaneous measurement of two-dimensional angular distribution of charged particles: Deceleration and focusing of wide-angle beams using a curved mesh lens

H. Matsuda and H. Daimon

Nara Institute of Science and Technology (NAIST),
8916-5 Takayama, Ikoma, Nara 630-0192, Japan
and CREST, Japan Science and Technology Agency (JST),
4-1-8 Honcho, Kawaguchi, Saitama 332-0012, Japan

A powerful method to measure the two-dimensional angular distribution of high-energy charged particles is proposed [2] based on the use of curved meshes [1]. Angle-resolved photoelectron spectroscopy at high photon energies is responsible for studying the core level of materials and for obtaining bulk or interface information utilizing a long sampling depth. However, the handling of high-energy charged-particle beams is not easy, because charged-particle beams become less focused or unfocused when the beam energy is considerably increased. In recent high-energy x-ray photoelectron spectroscopy, photon energies up to around 10 keV are used. Focusing the resulting high-energy beams under a conventional lens condition requires the beam divergence angle to be limited to a few degrees or less. We show that deceleration and focusing of high-energy charged particles with a divergence angle up to around ± 60 degrees are possible using a curved mesh lens. This opens new possibilities for high-energy x-ray photoelectron spectroscopy and related techniques. Some demonstrations of wide-angle deceleration lenses with acceptance angles up to ± 60 degrees are presented. Two examples are shown in Fig. 1.

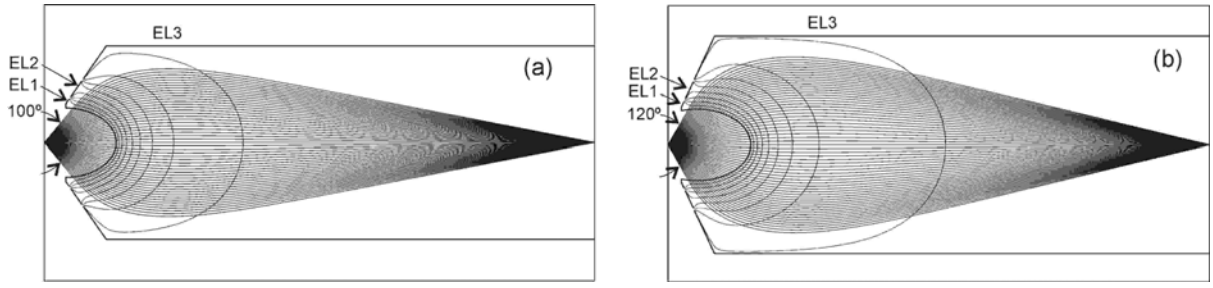

Fig. 1. Deceleration lenses with acceptance angles of (a) ± 50 degrees and (b) ± 60 degrees

References

[1] H. Matsuda, H. Daimon, M. Kato, and M. Kudo, Phys. Rev. E 71, 066503 (2005).
[2] H. Matsuda and H. Daimon, Phys. Rev. E, (2006) in press.