Standard Auger Spectra Taken with Standard CMA

Keisuke Goto

Nagoya Institute of Technology, Gokiso-cho, Showa-ku, Nagoya 466, Japan

We have constructed a novel cylindrical mirror analyzer(CMA)[1], which can detect the absolute Auger electron currents with electrometer. The CMA has almost ideal characteristics; the error in electric field of less than 0.1% and the residual magnetic field of less than 1mG. The surfaces of the sample have been immune from contaminations for the observed period of 6 months in the chamber. The stability of the primary electron is stable well within 1% during the experiments for half a day. The broad "rubbish" electrons in the background and the ghost of the spectra may not exceed 2% and 0.2%, respectively.

1. Characteristics of the CMA are shown in Fig.1-3. The Fig.1 is an observed FWHM of the elastically backscattered primary electrons with the acceleration voltages 1-5000V, showing the ultimate energy resolution of 0.24-0.25%. The apparent "error" in the energy scale observing an elastically backscattered primary electron is shown in Fig.2. A relativistic effect[2] is now evident. The relativistic effect should change the optimum sample position for the energies owing to the velocity and the spread of the incident angle to the CMA, Fig.3.

2. Results obtained for a Si(111) are shown in Fig.4-6. In Fig.4, the *KLL* and *KVV* are shown. The peak energy from XPS[3] is presented. We would like to propose these characteristic energies can be used for the precise energy scale calibration as an atomic standard. The Si $L_{2,3}VV$ ionization is given in Fig.5 being compared with theoretical works. The elastically backscattered primary electron currents are shown in Fig.6, which is corrected for the transmission of the CMA (right scale).

3. Full spectra from Al, Si, Cu, Ag, and Au are shown in Fig.7. Every spectra can be expanded as likely as Fig.4 in a 0.1eV of energy step. These spectra can be quantitatively compared with each other.

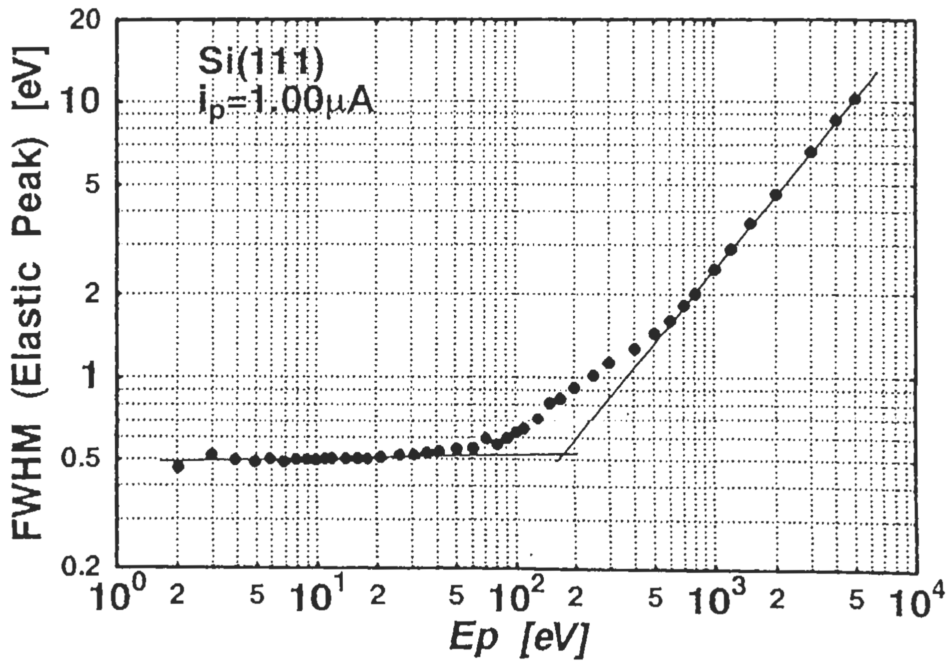
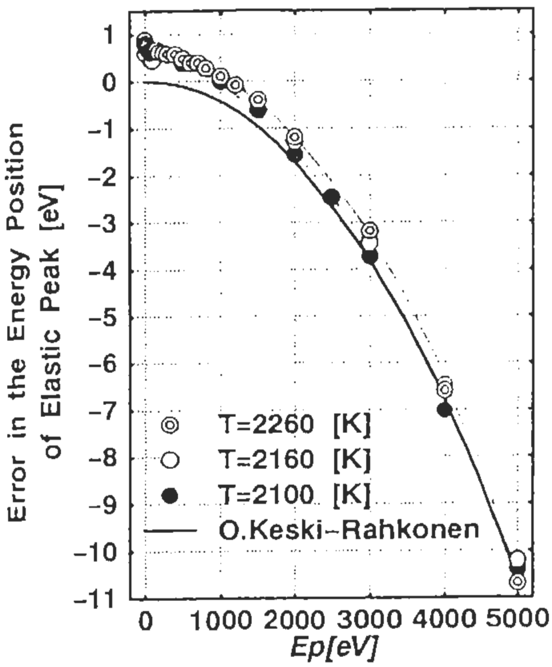


Fig. 1. The FWHM of elastically backscattered primary electron spectra for energies down to 1eV of acceleration voltage.



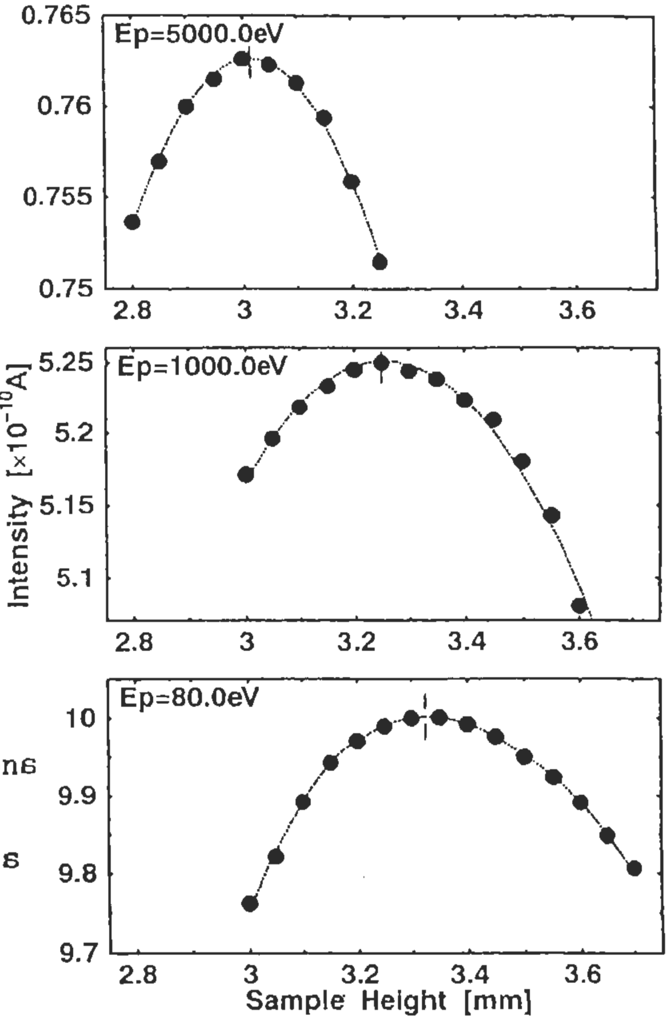


Fig.2. The observed energy "error" of the elastically backscattered primary electrons and the relativistic calculation. Fig.3(R). Peak heights of the elastically backscatt. pri.electrons vs the sample positions for the energies.

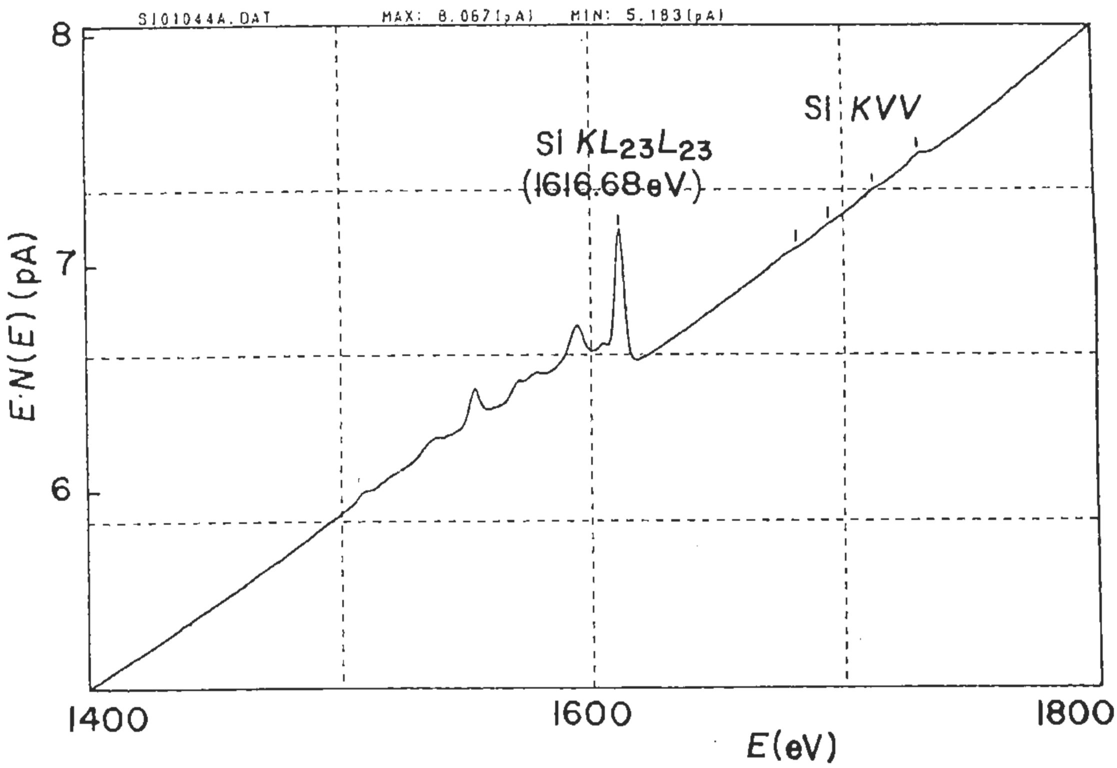


Fig. 4. The obtained Si(KLL and KVV) Auger electron spectra.

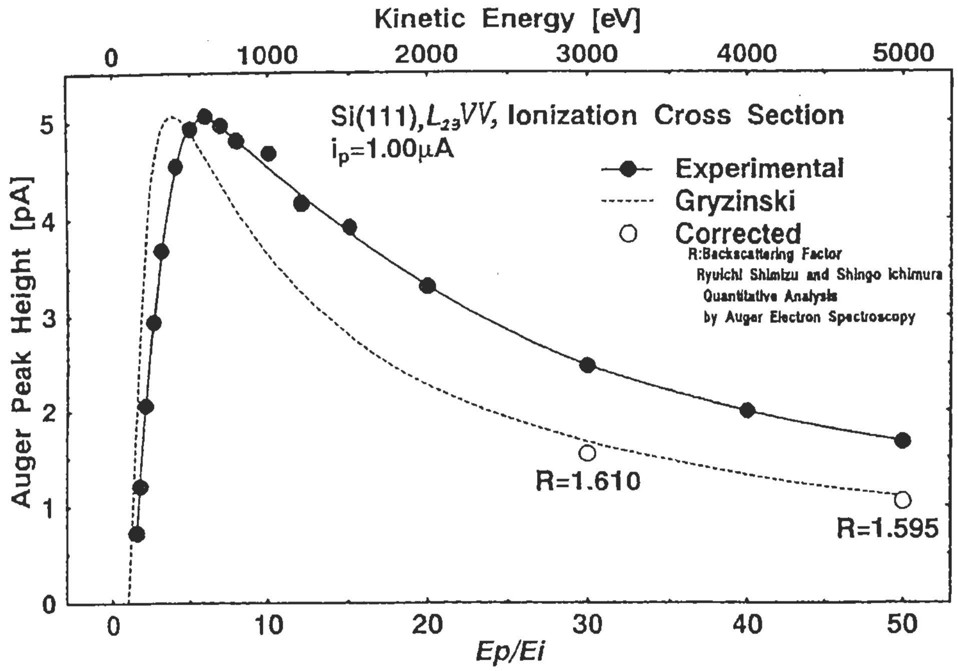


Fig. 5. The Si(L_{23}VV) Auger peak heights vs primary energies.

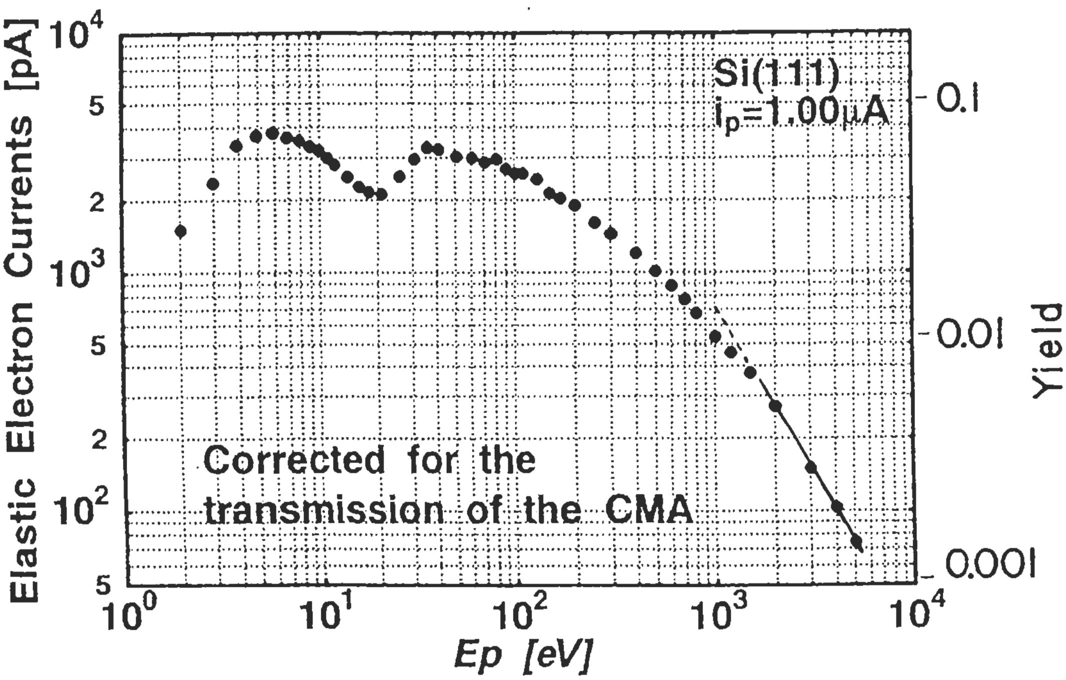


Fig. 6. The elastically backscattered primary electron currents from Si(111).

These results would confirm the obtained spectra to be a convincing candidate for standard. Professor R.Shimizu and Dr.J.Toth are very helpful in the relativistic discussion.

References

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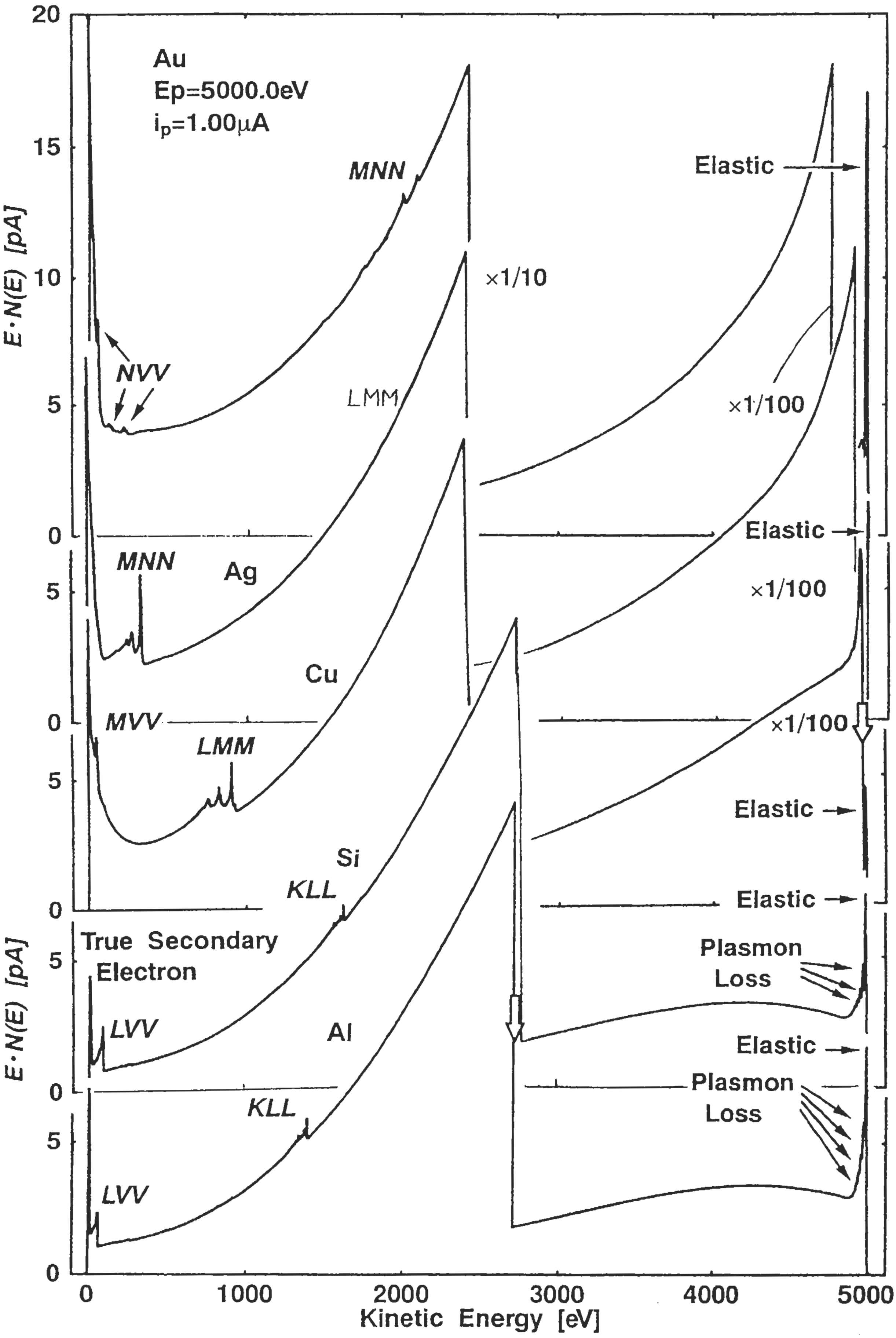

Fig. 7. The total energy distribution of Al, Si, Cu, Ag, and Au.