surface normal and the scattering angle was set to 45°. In the planar channeled spectrum, the yield reduction due to channeling effects, and surface peaks can be seen. Figures 2 (a) and (b) show the measured and simulated forward scattering spectra for Au and Si, respectively. The blue arrows in the figure indicate the scattering peaks from the top surface, and the subscripts indicate the charge state of Ne. For both Au and Si samples, the charge states of Ne^{+}, Ne^{2+}, and Ne^{3+} can be confirmed. In addition, strong multiple scattering effects are observed in the broad tail on the higher energy side than the energy indicated by Ne^{+} arrow in fig. 2 (b). The simulated spectra were reproduced by the SRIM calculation results, which were the energy and emission direction of the Ne ions scattered from the target surface into the vacuum. Furthermore, two models (M&Y [3] and CasP [4]) for the charge state distribution of Ne ions were added to the calculations. The simulated spectra generally reproduce the measured spectra. The M&Y model is in better agreement for Au, and the CasP model for Si. The red arrows in figure 2 (a) and (b) show the recoil energy of hydrogen at the top surface. In this energy region, the scattering yield, which is the background for the detection of hydrogen by ERDA, is about 20 times higher for the Si substrate than for the Au substrate.

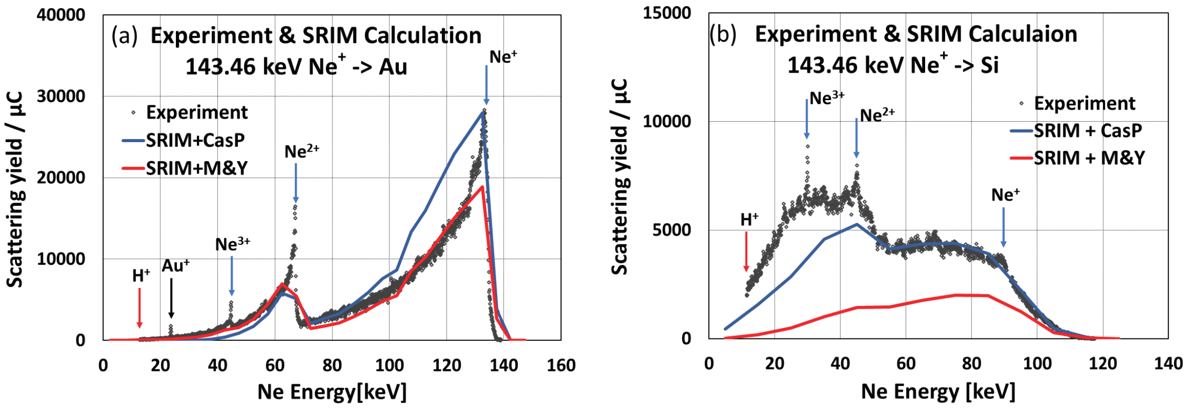

Fig. 2 (a) and (b). The measured and simulated forward scattering spectra for Au and Si, respectively. The blue and red solid lines show the results from CasP and M&Y, which are models of the charge state distribution of Ne, respectively.

References

[1] K. Mitsuhara, H. Okumura, T. Matsuda, M. Tagami, A. Visikovskiy and Y. Kido, *Nucl. Instrum. Methods B*, **2012**, *276*, 56.

[2] J.F. Ziegler, M.D. Ziegler and J.P. Biersack, *Nucl. Instrum. Methods B*, **2010**, *268*, 1818.

[3] J.B. Marion and F.C. Young, Nuclear Reaction Analysis – Graphs and Tables, North-Holland, Amsterdam, **1968**.

[4] P.L. Grande, G. Schiwietz, *Nucl. Instr. Meth. B*, **2009**, *267*, 859.