

HIGH-RESOLUTION SOFT X-RAY SPECTROSCOPY OF 2.3keV/u Ne⁹⁺ IONS THROUGH Ni MICROCAPILLARY TARGET

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This work presents a high-resolution soft X-ray spectroscopy of highly charged ions after interaction with a Ni microcapillary target. The microcapillary target consists of many capillaries with diameter of about 200nm and length of about 1 μ m.^{1, 2)} We have developed a high-resolution soft X-ray spectrometer, which consists of a concave grating and a back-illuminated CCD (Charge Coupled Device). Its energy resolution in FWHM was 7.6eV at 900eV, 1.4eV at 300eV, and the energy accuracy was ± 1.3 eV at 900eV, ± 0.5 eV at 300eV.³⁾

For this experiment we used a beam of 2.3keV/u Ne⁹⁺ ions from a 14.5GHz Caprice type electron cyclotron resonance (ECR) ion source in RIKEN.

Figure 1 shows two spectra of Ne *K α* X-rays taken with the spectrometer: The bold solid lines is for the Ne ions which transmitted through the Ni capillary and the broken line is for the ions which directly hit a flat stainless steel at an incident angle of 30 degrees. The peak for the stainless steel target is observed at 849.5 \pm 1.3eV, which is identified to Ne *K α* X-rays predicted to appear at 848.6eV. It is seen that the peak skews to high-energy side indicating contributions from different number of L-shell vacancies. In the case of the capillary target, three sharp peaks were observed at 921.7 \pm 1.3eV, 913.4 \pm 1.3eV, and 895.4 \pm 1.3eV. According to theoretical calculation and reference data, the three peaks are attributed to core electronic transitions of He-like 1s2p ¹P₁ - 1s² ¹S₀ (922.1eV), 1s2p ³P₁ - 1s² ¹S₀ (914.9eV), and Li-like 1s2s2p ⁴P_{1/2,3/2} - 1s²2s ²S_{1/2} (895.0eV), respectively.^{4, 5)} The observed transitions with their core configurations are summarized in Table 1.

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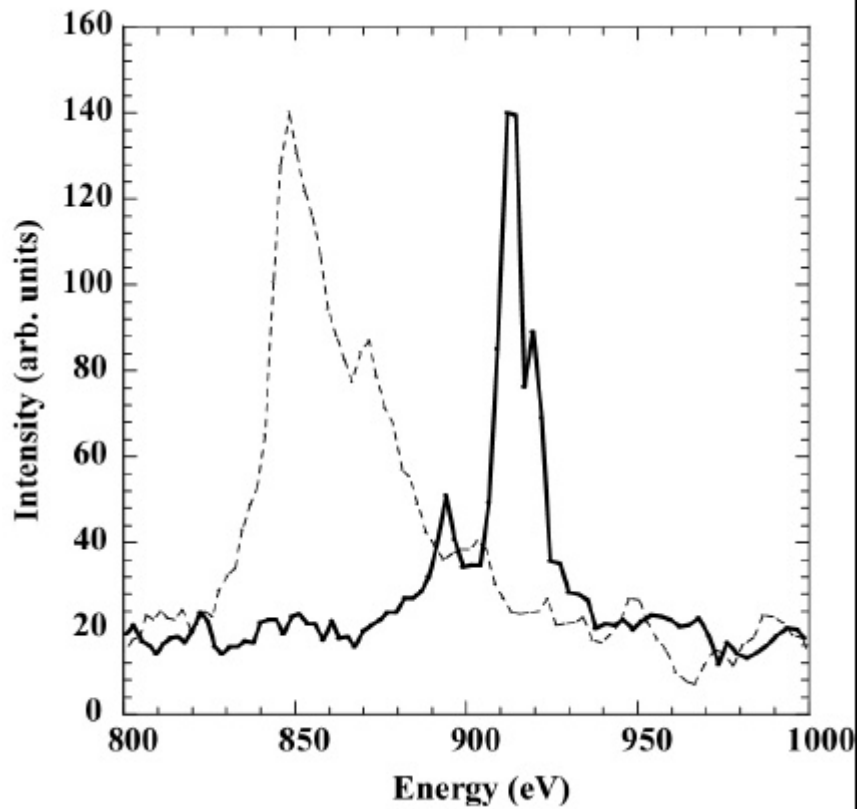


Fig. 1. Spectra of K X-rays measured with the spectrometer, for 2.3keV/u Ne^{9+} ions transmitted through a Ni capillary (bold solid line) and those hit a stainless steel plate (broken line).

Table 1. Electronic core configurations.

Experiment	Ref. data	Core configuration	Term
$921.7 \pm 1.3\text{eV}$	$922.1\text{eV}^{4)}$	$1s2p \quad 1s^2$	$^1P_1 \quad ^1S_0$
$913.4 \pm 1.3\text{eV}$	$914.9\text{eV}^{4)}$	$1s2p \quad 1s^2$	$^3P_1 \quad ^1S_0$
$895.4 \pm 1.3\text{eV}$	$895.0\text{eV}^{5)}$	$1s2s2p \quad 1s^22s$	$^4P_{1/2} \quad ^2S_{1/2}$ $(^4P_{3/2} \quad ^2S_{1/2})$

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