An ion current intensity measurement device in visible light emission measurements of the interaction of slow, highly charged ion with solid surfaces

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Synopsis In order to solve the problem of influence on measured spectrum caused by the ion current with unstable current intensity, we developed a set of device which can acquire and save the data of ion current intensities in real time during experiment. By means of off-line normalizing th saved data by PC, the influence will be eliminated efficiently.

The interaction of slow, highly charged ions has been extensively studied in the past decade. In previous those studied, information on highly charged ions with solid surface interaction was mainly obtained by measuring the emitted secondary particle, such as electrons, ions, X-rays, and so on [1-4]. However there are a few experimental studies on photon emission from interaction of highly charged ions with solid surfaces. In our experiment, visible light emission from slow, highly charged ions with an Al surface have been measured, The experiment was performed at the 14-GHz electron cyclotron resonance ion source (ECRIS) 320kV platform in Institute of Modern Physics, Chinese Academy of Sciences, which provided ions with energies up to q×320keV (where q is the charge state of the extracted ions).

During experiment, in order to solve the problem of influence on measured visible light caused by the ion current with unstable current intensity, we developed a set of current intensity measurement device which can provide the date for each testing point in real time that reflects the current intensity. Top view of the device is showed in Fig.1 as following:

The controller in this system is used to set integral time and execute start or stop instructions for spectrometer (Princeton Instruments model SP-2558). Moreover, it also outputs a pulse with information of integral time simultaneously to digital current intensity recorder(our own module) as intensity test counting enable signal for ion current converting when the former started, so that the pace of work of both spectrometer and the recorder can be synchronized.

When ion current enters into chamber and bombards the surface of target, then emitted photons in this interaction will be collected and integrated by spectrometer. Meanwhile,the incident ion current is also input into digital current integrator(Ortec model 439)to be converted into a serial of pulses of TTL level with fixed width. Then, under the control of enable signal from controller, these pulses will be counted, processed and transmitted to PC by digital current intensity recorder via USB interface for further off-line data analysis.

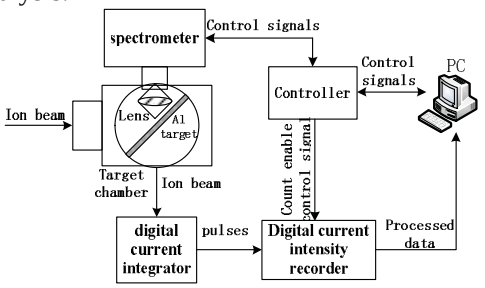

Figure 1. Top view of ion current intensities measurement device

By means of off-line normalizing the saved data by PC during experiment, the influence on measured spectrum as current intensity variation will be eliminated efficiently. There are experimental results in reference 5.

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