VI-W Study on RF-Photocathode for Compact X-Ray Sources

Electron storage rings are useful and practical devices as x-ray sources because which produce a number of photons owing to high electron current and various insertion devices. However, these synchrotron radiation facilities usually occupy large area and cost much. So that there have been many works to investigate more compact x-ray sources such as x-ray lasers and free electron lasers. It is also useful to use laser undulator radiation or backward Compton scattering caused by the interactions of electron beams with laser photons, if we provide enough electrons to produce practical intensity of x-rays. RF-photocathode would produce dense electron beam so that it is a useful candidate of a electron source. It is necessary to search good materials as the photocathode for construction of a practical compact x-ray source. Cesium telluride has reported to have a good quantum efficiency, we study about it.

VI-W-1 Measurement of Quantum Efficiency of Cesium Telluride as a Photocathode

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The photocathode for a x-ray source is required to have high quantum efficiency for production of practical intensity of x-rays. There have been a number of works[1-4] to test materials as photocathode. We used cesium telluride as the photocathode and studied quantum efficiency. Figure 1 shows a picture of the vacuum chamber in which the cathode was installed. Ultraviolet(UV) radiations, generated with a xenon lamp, were guided into diffraction grating. Monochromatic UV radiations from the grating passed through a entrance sapphire window of the vacuum chamber, then focused on the photocathode. Cesium telluride was made on a surface of a molybdenum block by vacuum evaporation method. Negative constant voltage of 100V was supplied to the photocathode.

Electric current flowing into the cathode was measured to derive the quantum efficiency which is shown in Figure 2 with wavelength of injected UV radiations. The maximum quantum efficiency is about 10% and is kept longer than hundred hours. For the further study, we should supply RF voltage and test the cathode whether it has a good performance as this experiment.

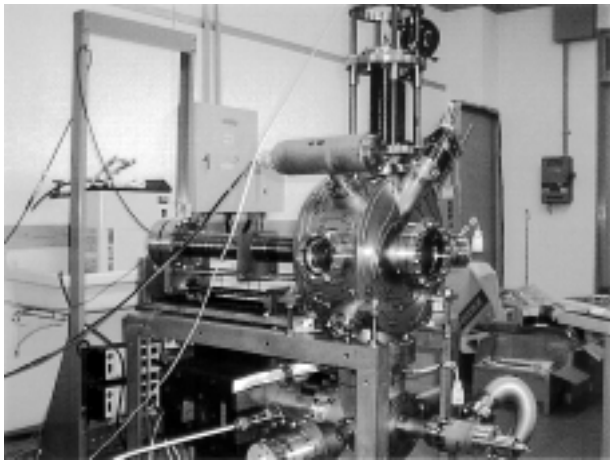

Figure 1. Vacuum chamber in which there is a photocathode. UV radiation is injected on the photocathode through one of a viewing port.

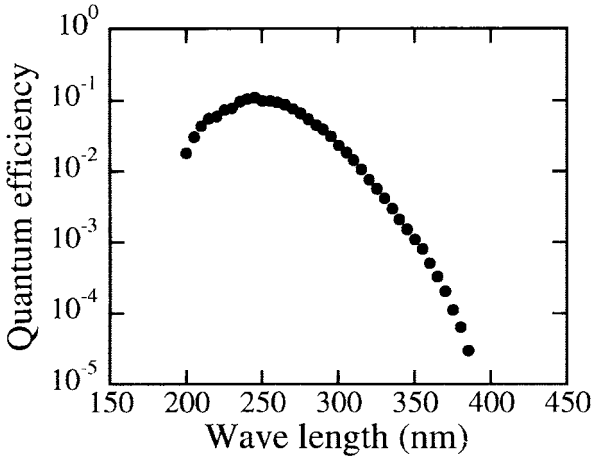

Figure 2. Quantum efficiency of cesium telluride with wavelength of injected UV radiations.

Reference

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