# Optical properties of "as-deposited" CsI photocathode in the VUV-UV spectral range

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## Introduction

Photon detectors are one of the most complex device used in nuclear and high energy physics (HEP) experiments for particle identification (PID). The gaseous photodetectors combing a solid photocathodes are considered to be more promising, in particular with cesium iodide (CsI) photocathodes [1]. These detectors having sensitive area of the order of few $m^2$, sensitive in the UV spectral range, are successfully employed in cherenkov detectors in numerous nuclear and particle physics experiments [1–3]. Furthermore, the advantage of CsI photocathode which is sensitive in the UV regions is high quantum efficiency (QE) and can be employed in liquid scintillation cryogenic detectors [4].

## Experimental Setup

Thermal evaporation technique has been used to deposit a 100 nm thick CsI film. The completed details about deposition process is described by Triloki, et al. [5].

In order to study the optical properties of CsI thin film in the spectral range of 120 nm - 240 nm, the Vacuum Ultraviolet Analytical Spectrophotometer (VUVAS) from McPherson, USA (model no. 1000) has been used. The system uses a high throughput vacuum monochromator, focused light source, a sample chamber capable of holding multiple samples, detectors, and an oil free vacuum pumping (or purge) system, see the schematic diagram of VUVAS-1000 in Fig. 1. The VUVAS-1000 directly measures reflectance and transmittance properties of Vacuum UltraViolet - UltraViolet (VUV-UV) optical components. Accurate measurement of optical properties can be made over a wide angular spread.

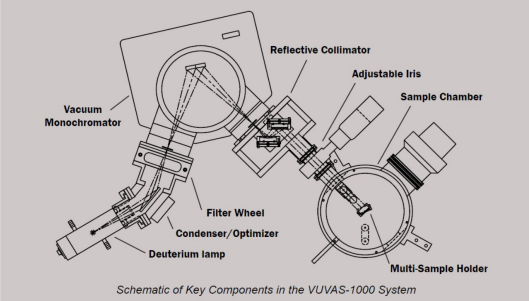


FIG. 1: A schematic view of McPherson VUVAS-1000 Spectrophotometer.

## Optical Properties

The optical properties of 100 nm thick CsI film have been studied in the spectral range of 120 nm - 240 nm by using VUVAS Spectrophotometer. The film has been deposited on magnesium fluoride (MgF2) substrate due to its transparency over an extremely wide range of wavelengths.

### A. Optical Transmittance

Fig. 2 shows the transmittance behavior of CsI film as a function of wavelength. It

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can be noticed that the transmittance remains constant at 20-30% in the wavelength range implying the film is semi-transparent in this wavelength range. The results were compared with that of C. Lu, et al. [6] and were found to be in agreement with the results obtained there, where they too implied the film to be semi-transparent in this wavelength range.

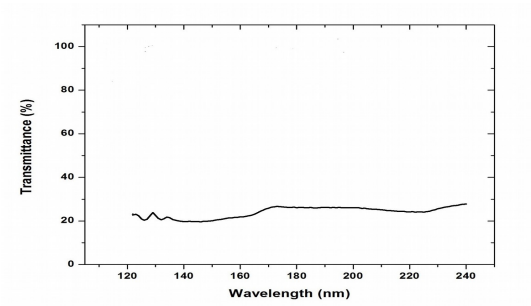


FIG. 2: The transmittance spectrum of CsI film as a function of wavelength in the spectral range 120 nm - 240 nm.

### B. Optical Reflectance

The reflectance behavior of CsI film as a function of wavelength is shown in Fig. 3. It can be observed that the reflectance is about 10% at 120 nm wavelength and remains almost constant at that in the entire range thereafter.

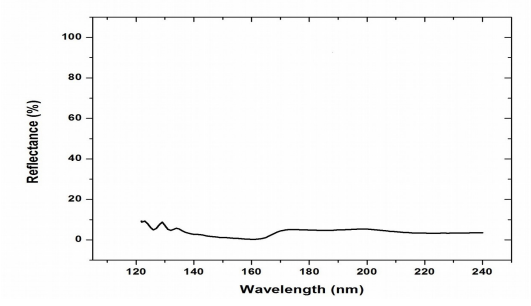


FIG. 3: The reflectance spectrum of CsI film as a function of wavelength in the spectral range 120 nm - 240 nm.

### C. Optical Absorbance

The values of absolute absorbance were calculated form the values of reflectance and transmittance by using the relation (1)

$$\mathbf{A = 100 - (T + R)} \qquad (1)$$

It varies between 60% to 80% in the whole wavelength range. It has a short peaks at 130 nm and 140 nm. It is observed to have a dip at 160 nm, see Fig. 4.

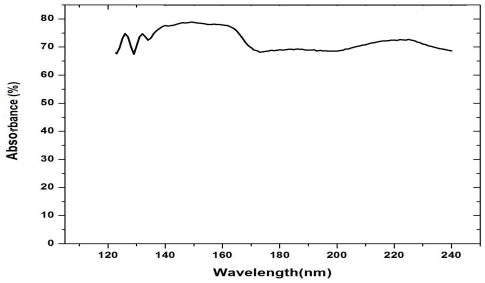


FIG. 4: The reflectance spectrum of CsI film as a function of wavelength in the spectral range 120 nm - 240 nm.

### References

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