

# Infrared ellipsometric spectroscopy of $\text{Hg}_{1-x}\text{Cd}_x\text{Te}$ bulk samples

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**Abstract**—The infrared spectroscopic ellipsometry of  $\text{Hg}_{1-x}\text{Cd}_x\text{Te}$  ( $x=0.195\sim 0.37$ ) bulk samples with different compositions were measured. The refractive index  $n$  and extinction coefficient  $k$  were obtained. An obvious refractive index enhancement effect was observed in the refractive index spectra for each composition. The energy position of the maximal refractive index value equals approximately that of the band gap. With the decrease of the component, the refractive index increased and the peak position shifted to the low energy direction, which consisted with the absorption edge. The refractive index  $n$  at  $E_g$  changed linearly with the composition  $x$ .

## I. INTRODUCTION

The importance of  $\text{Hg}_{1-x}\text{Cd}_x\text{Te}$  as an intrinsic infrared detector and its interesting application to physics has brought about numerous investigations, and its application has been extended to terahertz band [1,2]. The optical characteristics especially in the infrared range, is very important in the application of infrared optical detectors. Spectroscopic ellipsometry (SE) is a nondestructive and powerful technique to investigate the optical response of various materials. It provides a valuable tool to determine simultaneously the optical constants of the samples.

In this work, we measured the infrared spectroscopic ellipsometry of  $\text{Hg}_{1-x}\text{Cd}_x\text{Te}$  ( $x=0.195\sim 0.37$ ) bulk samples with different compositions. The refractive index  $n$  and extinction coefficient  $k$  of the  $\text{Hg}_{1-x}\text{Cd}_x\text{Te}$  ( $x=0.195\sim 0.37$ ) were obtained.

## RESULTS

Figures 1 and 2 showed the refractive index and extinction coefficient versus wavelength for the  $\text{Hg}_{1-x}\text{Cd}_x\text{Te}$  samples with different compositions ( $x=0.195\sim 0.37$ ) at room temperature. From figure 1, an obvious refractive index enhancement effect was observed in the refractive index spectra for each composition [3]. The energy position of the maximal refractive index value equaled approximately that of the band gap. Near the band edge, the refractive index  $n$  decreased rapidly, and with the increase of wavelength, the refractive index  $n$  decreased slowly. With the decrease of the component, the refractive index increased and the peak position shifted to the low energy direction. From figure 2, in the intrinsic region, the extinction coefficient  $k$  decreased rapidly with the increase of wavelength. With the decrease of the component, the absorption edge shifted to low energy direction, which consisted with the variation of the refractive index peak. The illustration showed the relationship between the refractive index  $n$  at  $E_g$  (solid square) and the composition. The straight line was a linear connection between arbitrary two points. It can be seen that the refractive index  $n$  at  $E_g$  changed linearly with the composition  $x$ .

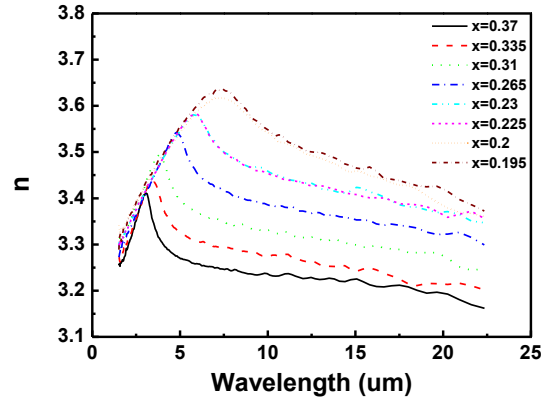


Fig. 1. The refractive index  $n$  of  $\text{Hg}_{1-x}\text{Cd}_x\text{Te}$  ( $x=0.195\sim 0.37$ ).

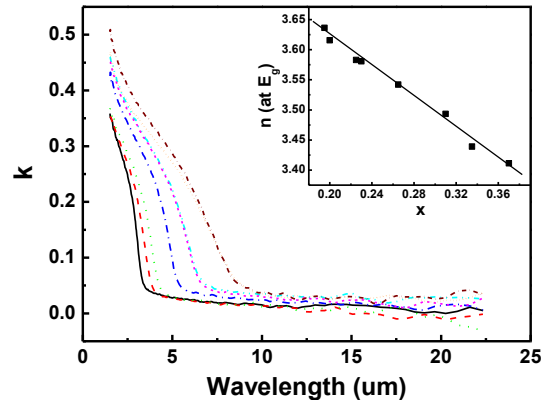


Fig. 2. The extinction coefficient of  $\text{Hg}_{1-x}\text{Cd}_x\text{Te}$  ( $x=0.195\sim 0.37$ ), the illustration is the room temperature refractive index  $n$  at band gap  $E_g$ .

## REFERENCES

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