

# ELECTRODEPOSITION OF TELLURIUM ATOMIC LAYER ON N-GAAS(100) SUBSTRATE

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In this presentation, the electrodeposition of Tellurium (Te) atomic layer on n-type GaAs(100) substrate will be presented. The coverage of Te on the substrate was estimated by Auger Electron Spectroscopy (AES). n-Type GaAs(100) is a compound semiconductor, doped with Si, and is hard to clean, compared to metal substrates, because of the reactivities of Ga and As [1]. Te atoms can be used for passivation, to protect the substrate from contaminants [2]. As-received n-GaAs(100) substrate was treated by ultraviolet (UV) ozone cleaning and 10 % HF acid. The substrate was then transferred to the ultrahigh vacuum (UHV) chamber, and cleaned by  $\text{Ar}^+$  ion bombardment. The substrate was also annealed to produce a smooth surface, so that a low energy electron diffraction (LEED) pattern was obtained. The clean substrate was then put into the Te solution (0.2 mM  $\text{TeO}_2$  + 50 mM  $\text{H}_2\text{SO}_4$  (pH 2.0)), and cyclic voltammetry (CV) was obtained.  $\text{Te}^{4+}$  ions were reduced ( $\text{Te}^{4+} + 4e^- \rightarrow \text{Te}^0$ ) at  $-0.1$  V (versus Ag/AgCl),  $-0.4$  V,  $-0.6$  V,  $-0.8$  V,  $-1.0$  V,  $-1.2$  V, and  $-1.4$  V. Auger spectra were obtained after each Te deposition, and the Auger ratios of Te/Ga, O/Ga, and As/Ga were plotted versus the Te deposition potential. From the Auger ratio plot (Fig. 1), bulk Te was resulted from deposition between  $-0.4$  V and  $-0.8$  V, and the reduction peak at  $-0.9$  V appears due to the reduction of Te to Telluride ion ( $\text{Te}^0 + 2e^- \rightarrow \text{Te}^{2-}$ ). The 1.8 Auger ratio for Te/Ga at  $-1.0$  V suggests that only a Te monolayer was left at  $-1.0$  V and below. The monolayer of Te appears to be an effective passivation for the substrate. There was an attempt to grow CdTe on InP(100) substrate in this lab [3]. Growth of compound semiconductors, such as InTe, InAs and CdTe, on n-GaAs(100), by electrochemical atomic layer deposition (ALD), will be attempted.

## References

- [1] M. Muthuvel and J.L. Stickney, J. Electrochem. Soc. 153, C67 (2006).
- [2] T. Ohno, Surf. Sci. 255, 229 (1991).
- [3] M. Muthuvel and J.L. Stickney, Langmuir, 22, 5504 (2006).

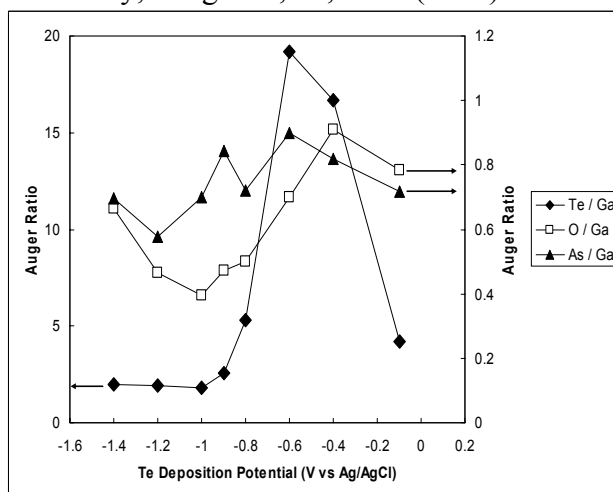


Fig. 1 Auger ratios versus the Te deposition potential.