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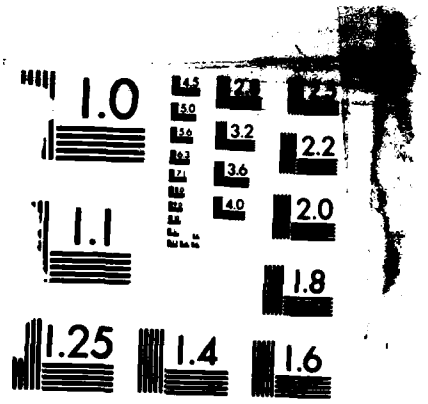

Interim Status Report No. 2

SEMICONDUCTING TRANSITION METAL SILICIDES FOR ELECTRO-OPTIC VSLI INTERCONNECTS

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For The

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PROGRESS REPORT #2

November 27, 1985

During the period since October 15, 1985, when the first project report was submitted, optical and electrical measurements of the chromium disilicide forbidden energy gap have been made. These activities are detailed below:

Electrical Bandgap Determination

The samples used for this experiment were formed by sputtering chromium onto silicon (100) wafers which had been thermally oxidized and then coated with a polysilicon layer. The details of this procedure are outlined in Progress Report #1. Chromium disilicide layers were formed with annealing temperatures ranging from 500 to 1100C to investigate the effect of this fabrication parameter on the forbidden energy gap of the films.

The electrical resistivity of the films was measured as a function of temperature from 295 to 773K. This was done in a diffusion-pumped vacuum chamber containing a custom-built high temperature four-point probe. The measurements were made in vacuo to prevent oxidation of the films.

The logarithim of the electrical conductivity versus 1000/T is shown in Figure 1 for a representative sample annealed at 773K. There does appear to be a variation of the thermal activation with the anneal temperature of the sample. Further work is being done to clarify this trend. The activation energy

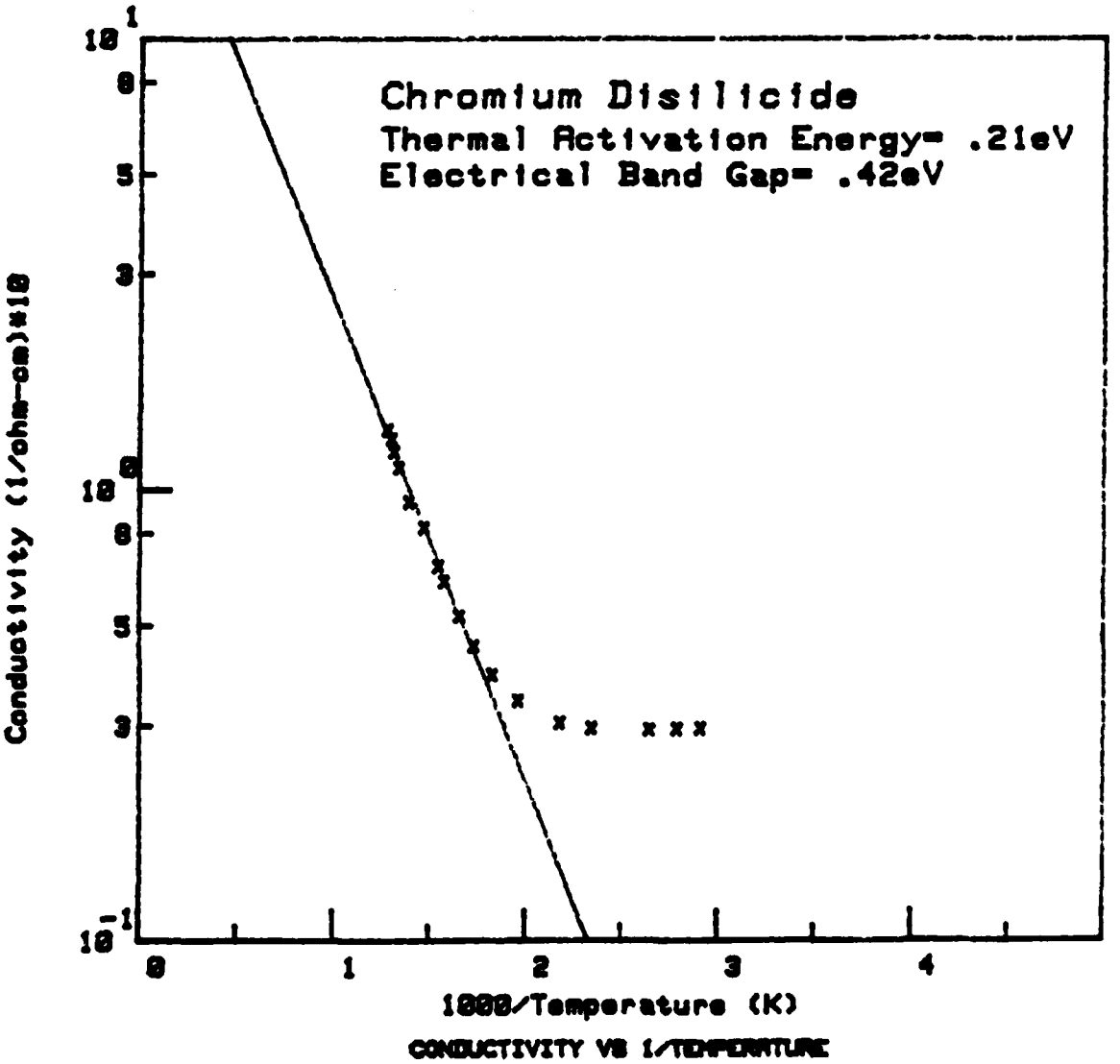
determined from Figure 1 is 0.21 eV. The simplest interpretation of this value is that it is equal to half the forbidden energy gap of the material, which would be 0.42eV.

Optical Bandgap Determination

Some initial measurements of the optical transmittance and reflectance of the chromium silicide films are shown ~~in Figure 2,~~ using films formed on bare silicon wafers. These data have been analyzed using a computer model of the silicide film-silicon substrate system. Figure 3 shows the spectral dependence of the optical absorption constant obtained from this analysis. A preliminary estimate of the optical energy gap is 0.40 - 0.45eV, as obtained from this figure. The estimate is in rough agreement with the electrically determined bandgap value discussed above.

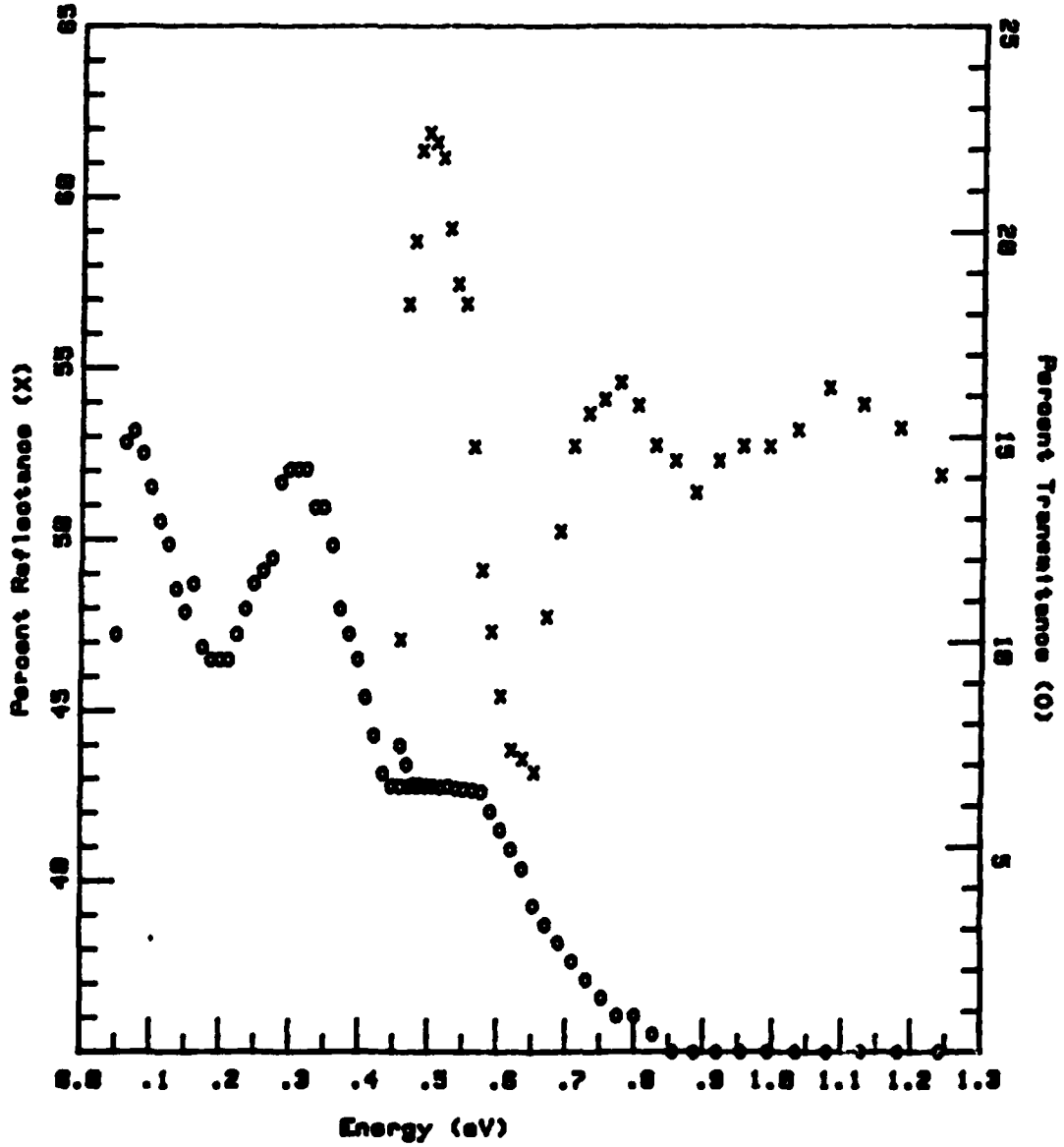
Preparations for the Work on Manganese and Iridium Silicides

The manganese and iridium sputtering targets have not arrived from the vendor. The work on these materials will begin as soon as these targets are received.



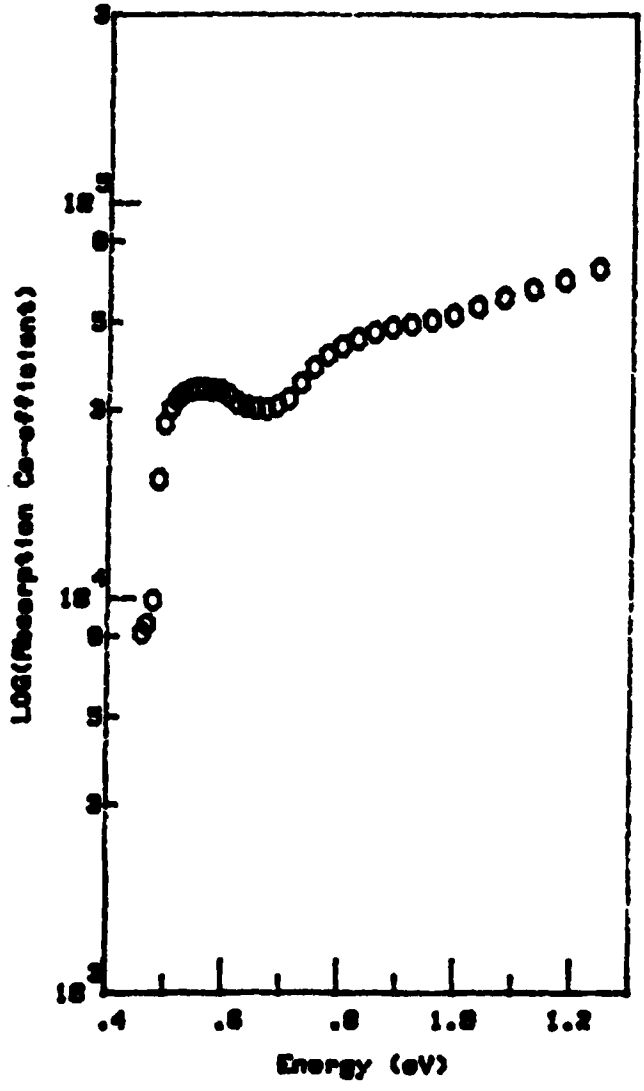
CONDUCTIVITY VS 1/TEMPERATURE

FIGURE 1



TRANSMISSION AND REFLECTANCE VERSUS ENERGY

FIGURE 2



ENERGY VS ABSORPTION COEFFICIENT

FIGURE 3

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