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ZnSe Epitaxial Layers Grown by MOCVD Using Dimethylzinc and Diethylselenide

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Zinc selenide is a wide bandgap semiconductor which is expected to be a candidate for blue light-emitting devices. In recent years, high quality ZnSe films have been grown by MOCVD^{1,2)} and MBE³⁾ at low growth temperature. For the case of MOCVD growth from dimethylzinc (DMZn) and hydrogen selenide (H₂Se) sources, however, there takes place a parasitic reaction. Stutius¹⁾ and Fujita et al.²⁾ have tried to prevent such a reaction by introducing DMZn just above the substrate surface in the low pressure reactor. However, uniform films have been hard to obtain even as a result of such consideration on the gas inlet configuration.

This paper is concerned with the MOCVD growth of high quality ZnSe films utilizing DMZn and diethylselenide (DESe) as source materials. It is noted that the present growth is free from an undesirable premature reaction, resulting in formation of uniform films on the substrate.

Two gas inlet tubes were terminated at 16cm above the substrate surface in a vertical quartz reactor. A SiC-coated graphite susceptor was heated by the radiation from a quartz-iodine lamp furnace. The transport rates of DMZn and DESe were typically 1.0×10^{-5} mol/min and 2.0×10^{-5} mol/min, respectively. The total flow rate of H₂ gas was kept at 200cc/min. ZnSe films were grown at atmospheric pressure on GaAs (100) substrates, which had been etched for 2 min at 40°C in a 4:1:1 solution of H₂SO₄:H₂O₂:H₂O prior to growth.

As seen in Fig. 1, the growth rate increases with growth temperature, indicating that the total growth rate

is not controlled by the usual mass transport diffusion of the source gases.

We have tried to introduce DMZn just above the substrate as is done in the conventional MOCVD growth of II-VI compounds. However no enhancement of the growth rate has been noticed, indicating that a parasitic reaction is not taking place in the present source material combination.

A specular surface and uniform thickness was typically obtained for the layer thickness below about $2\mu\text{m}$ when the growth temperature was lower than 460°C (Fig. 2).

In summary highly uniform epitaxial layers of ZnSe were successfully obtained by MOCVD using DMZn and DESe as the source materials. A remarkable result is that the present growth is free from the parasitic reaction which has been typically encountered in the conventional MOCVD growth of II-VI compounds using H_2S or H_2Se as the group VI atom source.

References

- 1) W. Stutius, Appl. Phys. Lett. 33 (1978) 656.
- 2) S. Fujita, Y. Matsuda and A. Sasaki, to be published.
- 3) T. Yao, M. Ogura, S. Matsuoka and T. Morishita, Appl. Phys. Lett. 43 (1983) 499.

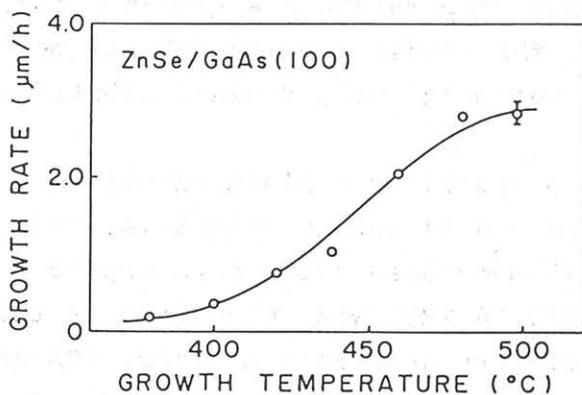


Fig. 1

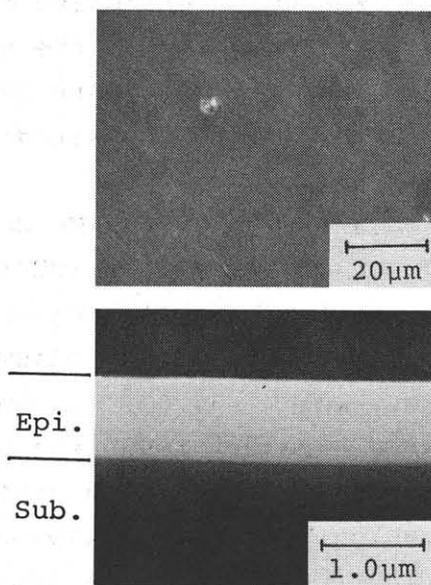


Fig. 2