TMIn と金属 Ga のトランスメタル化による TMGa 生成の高分解能質量分析

Direct analysis of transmetalation between TMIn and Ga by High-Resolution Mass Spectrometry

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AlInN is a promising material to replace AlGaN for high-frequency HEMT because of a higher bandgap, large spontaneous polarization, and the strain of AlInN can be adjusted to tensile or compressive. However unintentional gallium (Ga) incorporation is a serious problem for AlInN barrier growth when using close coupled showerhead MOVPE reactors, which results in loss of control on the alloy composition and lower reliability of devices[1][2]. It is supposed that a transmetalation reaction between tranfers methyl groups from $(CH_3)_3In$ (TMIn) to metallic Ga deposited on the showerhead mobilises the Ga.We employed a high-resolution time-of-flight mass spectrometry (infiTOF-UHV, KANOMAX JAPAN INC.) to investigate the transmetalation process.

Fig.a shows the setup [3]. TMIn and N_2 carrier gas are introduced into the reactor onto metallic Ga. The reacted gas was sampled downstreams by the TOF-MS system. $(CH_3)_2In$ (DMIn) and $(CH_3)_2Ga$ (DMGa) are main fragments of TMIn and $(CH_3)_3Ga$ (TMGa) ionization [3]. The intensity of DMGa increases strongly when TMIn is flown (Fig.b) at 400°C. It should be emphasized that no TMGa was introduced in the reactor, the DMGa signals must result from transmetalation on the metallic Ga with TMIn. Our results showed that formation of DMGa from transmetalation between Ga and TMIn is indeed plausible to explain the Ga incorporation during AlInN growth. There is also temperature dependence of this reaction which will be discussed in presentation.

Acknowledgement

This work was supported by MEXT “Program for research and development of next-generation semiconductor to realize energy-saving society.”

References

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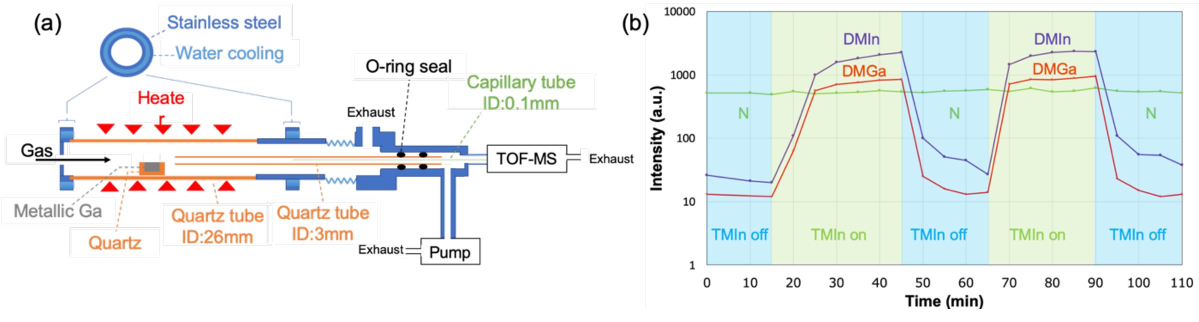

Fig. (a). Gas monitoring system[3] (b). DMGa and DMIn intensity change by TMIn flow line on/off at 400°C