Novel precursors for Ga(NAs) MOVPE growth with potentially less carbon incorporation for optoelectronics application

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III/V semiconductors containing small amounts of Nitrogen are discussed in the context of several solar cell and laser applications. Such applications are typically hampered by the large amount of Carbon incorporation into the layers, which either stems from the Nitrogen precursor or from the group III-sources, where the Nitrogen – due to the high strength of the C-N bond – leads to the incorporation of C from the organic rest groups. Furthermore, in the growth of these materials, a large excess of the N-precursor has to be offered in the gas phase in order to incorporate only small amounts of N. Conventionally UDMHy (unsymmetric dimethyl hydrazine) is used as a nitrogen precursor in MOVPE (metal organic vapour phase epitaxy) growth of dilute nitrides. We synthesized and purified a novel precursor (Di-tert-butyl-arsano-amin) for use in dilute nitride growth. This precursor has the advantage that no C-N bond exists in the molecule, which could reduce the C incorporation and increase the efficiency of semiconductor devices. We used this molecule – together with TEGa (triethylgallium) and, in some experiments, also with TBAs (tertiarybutylarsine) – in low temperature growth of Ga(NAs).

We observe an extremely highly efficient N-incorporation from this molecule. It is also observed that the surface is smooth even in experiments without TBAs. The layer structures grown using DTBAA exhibit high structural quality, as shown in the following figure. Also, the quantum well structures exhibit room temperature photoluminescence at a position that would be expected from the N-content measured from XRD.

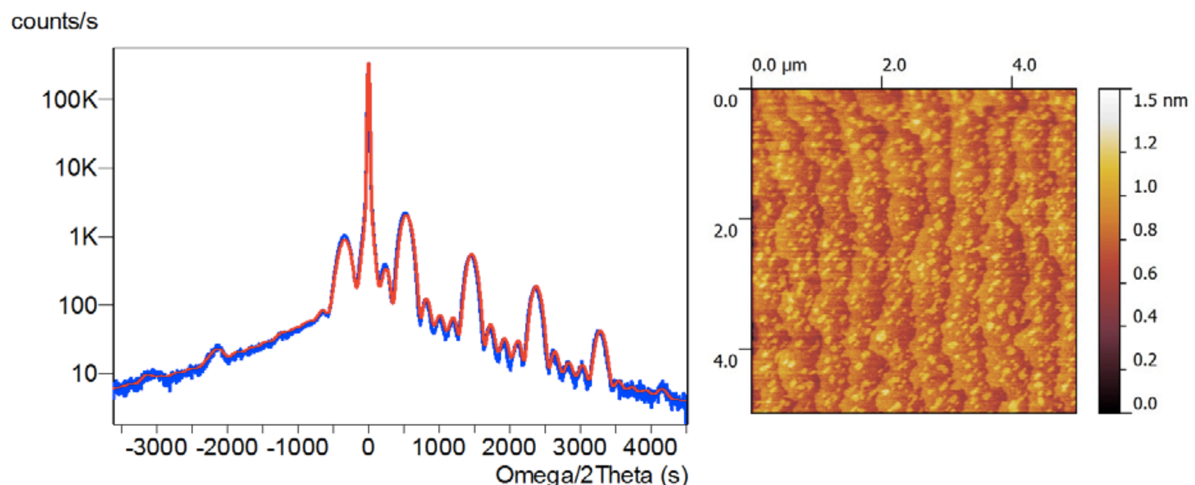

Fig. 1: HRXRD profile of a GaNAs sample on the left and an AFM picture of a GaNAs surface.

This presentation will present a systematic study of incorporation characteristics of N from this novel precursor. In addition, C-impurity levels will be compared to those known from growth using UDMHy.