Growth of InN by high-pressure chemical vapor deposition: optical monitoring

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Motivation

Temperature (K)

HPCVD reactor:

Design employs a pulsed precursor injection scheme, which is essential for:
- compression of precursors to reactor pressure,
- optimization of gas phase reactions,
- engineered nucleation kinetics and layer growth,
- analyzing the gas-phase and surface decomposition dynamics in real-time.

Real-time monitoring techniques applied: UVAS, PARs, and LLS.

Decomposition Kinetics: Ammonia and TMI

Reduction of flow-velocity and increase of growth temperature:
- 3D-nucleation
- LLS increases 10 fold
- Strong absorption
- Pronounced surface chemistry

Flow characterization:

Three distinct features:
- systematic TMI pulse broadening
- initial decrease of the absorption peak maximum with an increase in the pressure further increases.
- systematic shift in the pulse arrival time.

HPCVD system for the growth of InN and related materials:
- Real-time optical monitoring essential for understanding of growth process
- Gas phase decomposition kinetics of ammonia and TMI studied by UVAS
- In situ absorption measurement during growth at 900 K with a pressure of 100 bar
- Three features:
  - Nucleation
  - Steady-State Growth

InN nucleation and growth monitoring: PAR & LLS

Absorption

Summary:

• HPCVD system for the growth of InN and related materials
• Real-time optical monitoring essential for understanding of growth process
• Gas phase decomposition kinetics of ammonia and TMI studied by UVAS
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Conclusion

- HPCVD system for the growth of InN and related materials
- Real-time optical monitoring essential for understanding of growth process
- Gas phase decomposition kinetics of ammonia and TMI studied by UVAS
- In situ absorption measurement during growth at 900 K with a pressure of 100 bar
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