Advanced Electronic Materials Initiative at the University of Oklahoma

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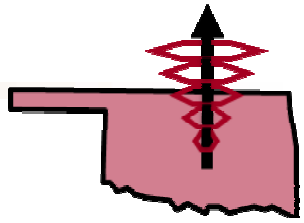
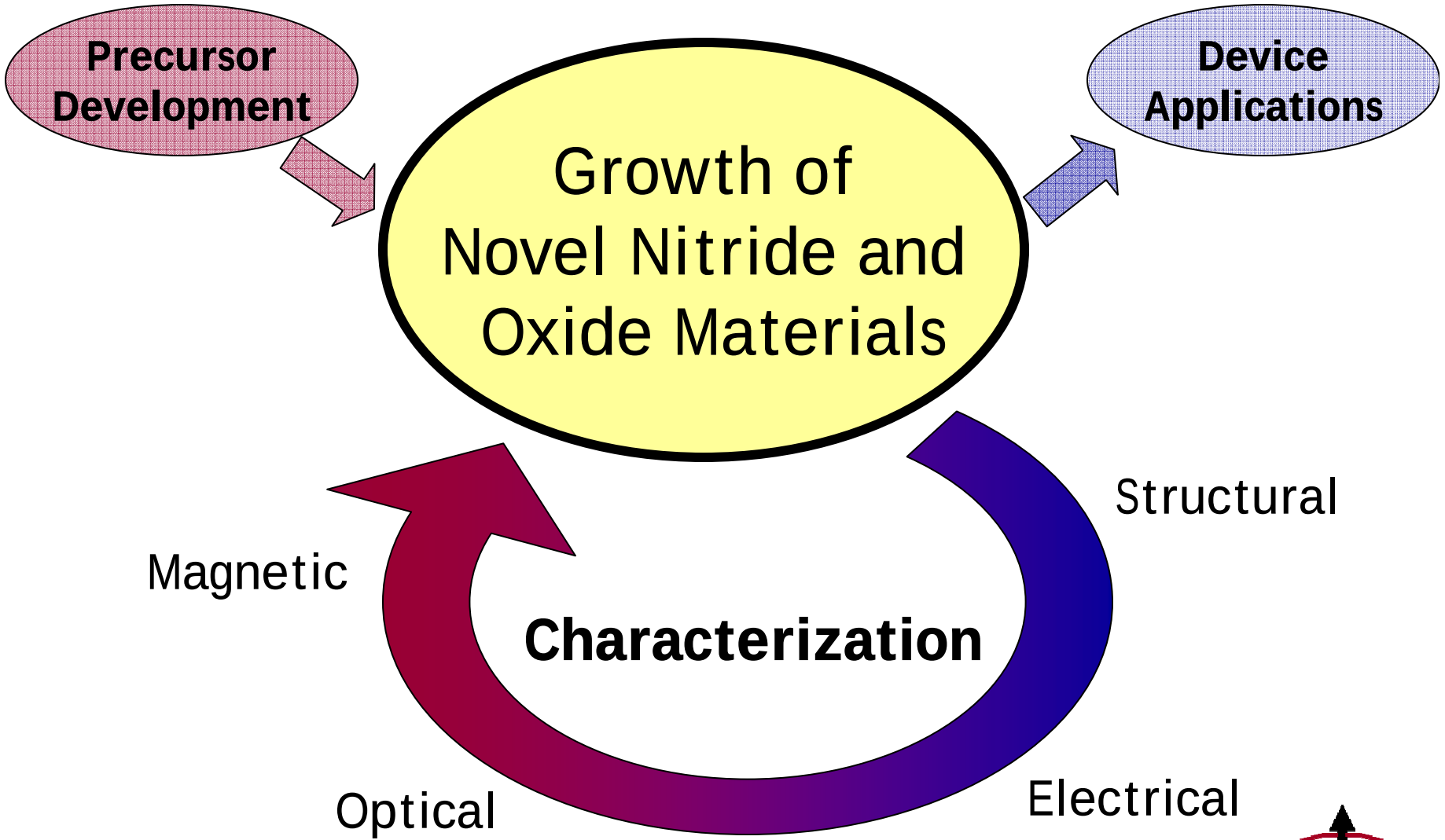


Theme: Novel materials for (elec-, optoelec-, spin-)tronics



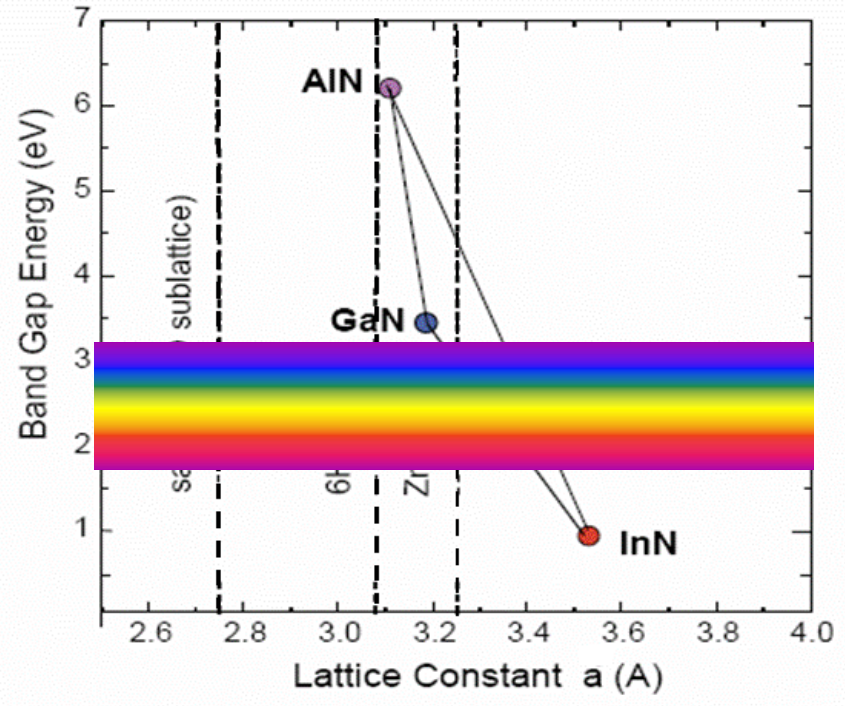
III-nitrides for Extreme Optoelectronics

Benefits of III-Nitride materials:

- Materials suitable for green to UV emitters
- Applications in energy-efficient lighting, biological agent detection, water purification, communications

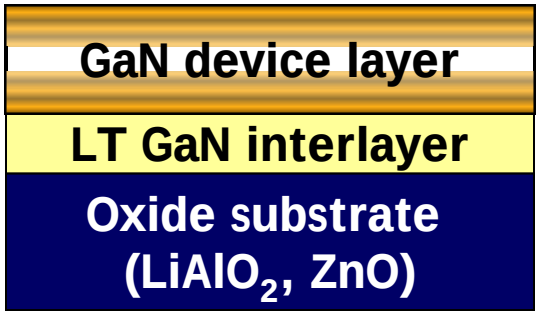
Challenges of nitride growth:

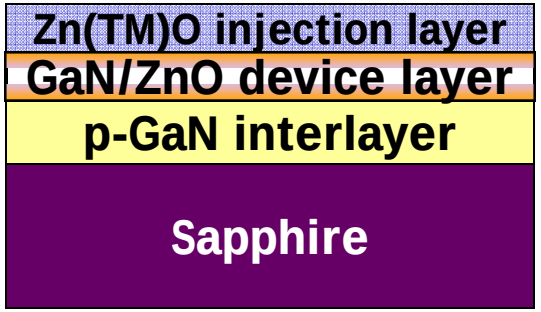
- No lattice matched substrates
- Polar material
- Asymmetric doping (no shallow acceptors)
- High temperature growth – difficulty in nitrogen incorporation

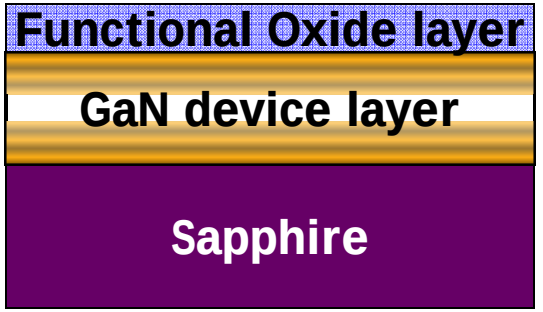


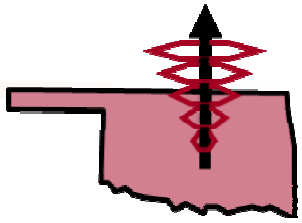
Hybrid Growth of Oxide-Nitride heterostructures

- Opportunities
  - Lattice-matched heteroepitaxy
  - Multifunctional semiconductor devices
  - Integrated III-V/II-VI or complex oxide electronics and optoelectronics
- Challenges
  - Process compatibility
  - Interface quality
  - Materials optimization
  - Device engineering



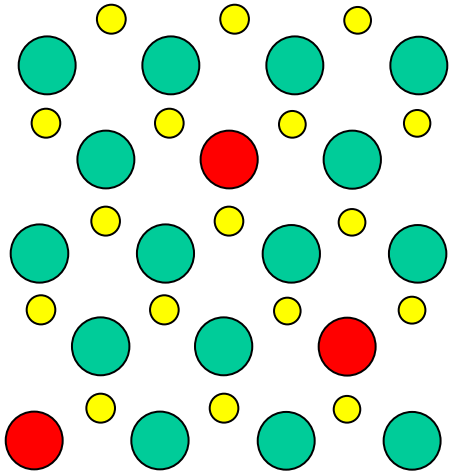






Magnetic ordering in ferromagnetic semiconductors

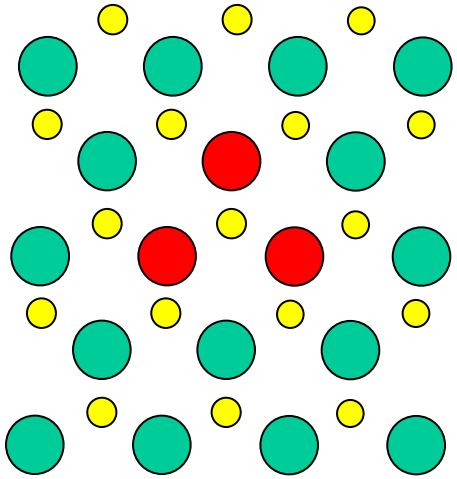
Dilute



- Random TM distribution
- Long-range FM coupling

Dietl *et al.* Science 287 (2000) 1019

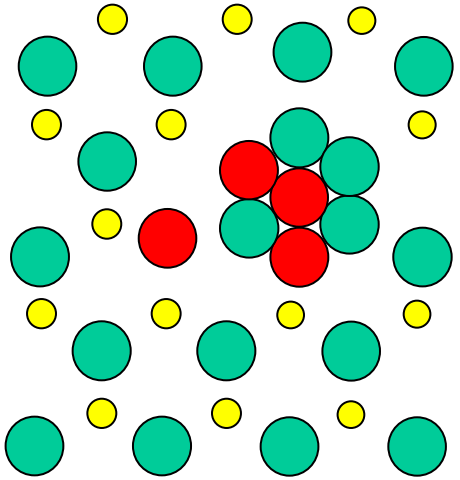
Clustered



- Embedded Mn-rich clusters
- Enhanced magnetic moments

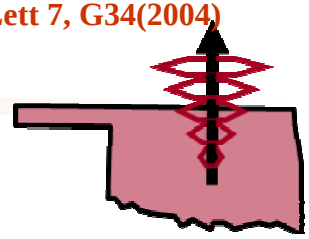
Rao and Jena, Phys Rev Lett 89, 185504 (2002)

Phase-Separated



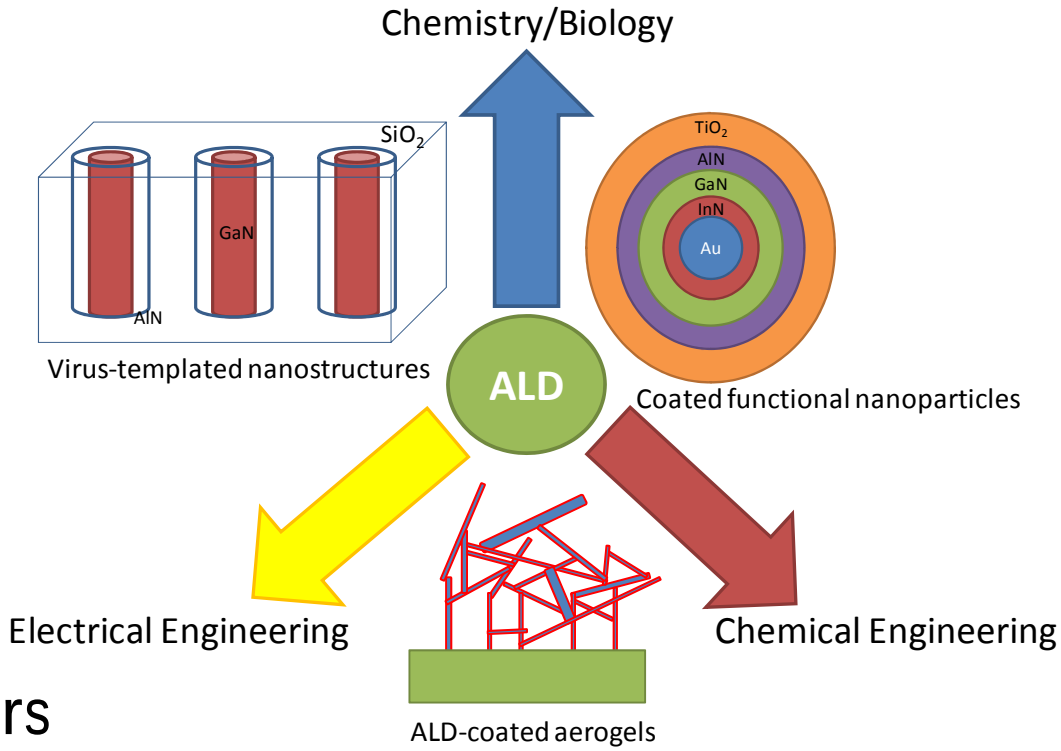
- Ferromagnetic phases segregate
- ex: $Ga_xMn_{y,}$ Mn_xN_y

Thaler et al., Electrochem Solid State Lett 7, G34(2004)



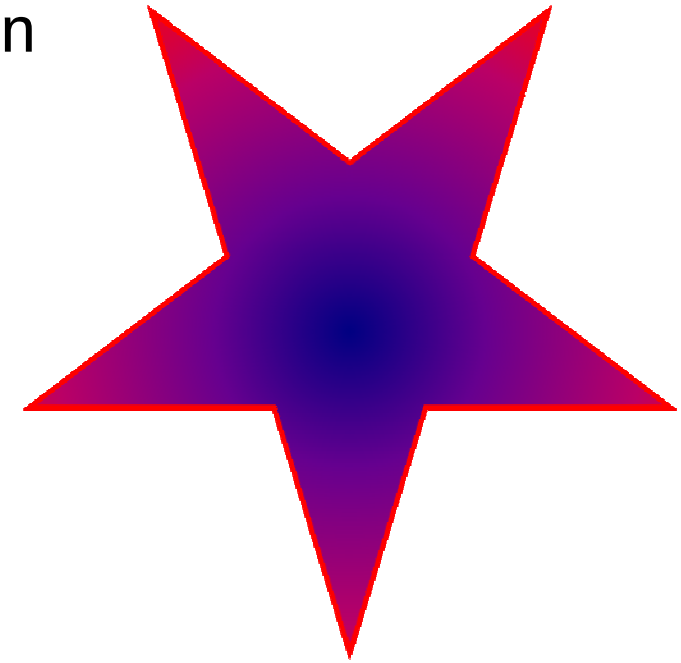
Atomic Layer Deposition for Functional Nanostructures

- Goals
  - Precise atomic level control of growth
  - Integration with nanoscaled and patterned templates
- Applications
  - High surface area photocatalysts
  - Shape controlled emitters and detectors
  - Energy generation and harvesting



NanoNet Contribution to the efforts

Nanonet support enabling contribution for future efforts in nanoscale materials development for device research



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