

# Flux Growth of Zinc Oxide and Manganese-substituted Zinc Oxide crystal

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## Outline

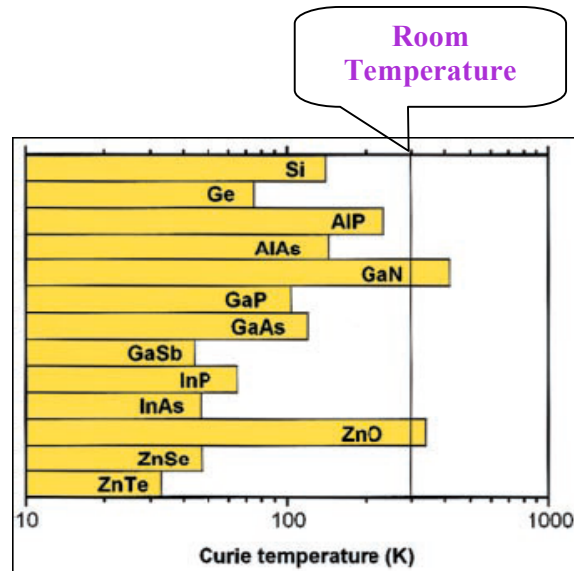
- Motivation
- Solution Crystal growth
  - A. Hydrothermal
  - B. Molten Flux
- Experiment
- Result & Discussion
- Conclusion

# Why ZnO?

Wide-band gap semiconductor

Theoretically:  
High  $T_c$  (room temperature)  
ferromagnetic material  
 $N=3.5 \times 10^{20} \text{ hole cm}^{-3}$

ZnO has higher binding energy than GaN



T. Dietl, H. Ohno et al. *Science* **287** 1019, 2000

# Solution Crystal Growth-Hydrothermal

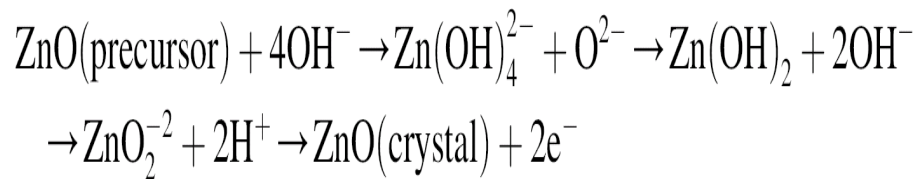
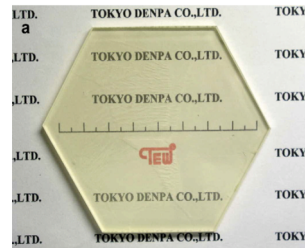
- **Hydrothermal Growth**

- A. Aqueous solution

- B. High pressure

- C. Seed

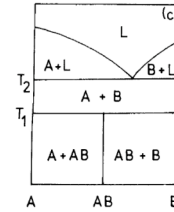
- D. Minerizer: NaOH/KOH for ZnO



D. Ehrentraut et al. *Progress in Crystal Growth and Characterization of Materials* **52**, 280, 2006

# Solution Crystal Growth-Molten Flux

- The desired phase:
  - A. Decompose before melting
  - B. Melt incongruently
  - C. High melting point (ZnO)
  - D. Phase transition before melting point



- Flux requirements:
  - A. Low melting point
  - B. Low vapor pressure
  - C. Large working area
  - D. Low melting point
  - E. Easy separate flux from crystal

