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Novel Alkali Metal Amidogallates as Intermediates in Ammonothermal GaN Crystal Growth

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- **Highlights**

- We have synthesized alkali metal amidogallates under ammonothermal conditions
- These compounds present likely intermediates in ammonothermal GaN crystal growth
- Dominating dissolved species in supercritical ammonia is probably $[Ga(NH_2)_4]^-$ for lithium and sodium amide as mineralizers
- The amidogallates exhibit same retrograde solubility as observed for GaN under the applied process conditions

Abstract

Single crystals of lithium tetraamidogallate, $Li[Ga(NH_2)_4]$, were obtained from the reaction of Ga metal and $LiNH_2$ in supercritical ammonia at a pressure of 250 MPa and temperature of 400 °C. Two structural modifications were characterized by single crystal X-ray diffraction: a = 5.849(1) Å, b = 12.640(3) Å, c = 6.858(1) Å, β = 92.56(3) °, Z = 4, space group $P2_1/n$; a = 6.005(1) Å, b = 7.394(2) Å, c = 6.005(1) Å, β = 103.51(3) °, Z = 2, space group $P2_1$. Disodium tetraamidogallate amide, $Na_2[Ga(NH_2)_4]NH_2$ (a = 11.748(2) Å, b = 6.681(1) Å, c = 9.665(2) Å, Z = 4, space group *Pnma*), was grown ammonothermally (p = 130 MPa, T = 580 °C) as single crystals in the course of synthesizing wurzite GaN employing $NaNH_2$ as an