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# Novel Alkali Metal Amidogallates as Intermediates in Ammonothermal GaN Crystal Growth

Shiyu Zhang<sup>a</sup>, Nicolas S. A. Alt<sup>b</sup>, Eberhard Schlücker<sup>b</sup>, Rainer Niewa<sup>a,\*</sup>

[a] Universität Stuttgart, Institut für Anorganische Chemie, Pfaffenwaldring 55, 70569 Stuttgart

[b] Friedrich-Alexander-Universität Erlangen-Nürnberg, Lehrstuhl für Prozessmaschinen und Anlagentechnik, Cauerstr. 4, 91058 Erlangen

Corresponding author: Prof. Dr. Rainer Niewa, Universität Stuttgart, Institut für Anorganische Chemie, Pfaffenwaldring 55, 70569 Stuttgart, Tel.: ++49(0)711-685-64217, rainer.niewa@iac.uni-stuttgart.de

## • 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  $[\text{Ga}(\text{NH}_2)_4]^-$  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,  $\text{Li}[\text{Ga}(\text{NH}_2)_4]$ , were obtained from the reaction of Ga metal and  $\text{LiNH}_2$  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:  $a = 5.849(1) \text{ \AA}$ ,  $b = 12.640(3) \text{ \AA}$ ,  $c = 6.858(1) \text{ \AA}$ ,  $\beta = 92.56(3)^\circ$ ,  $Z = 4$ , space group  $P2_1/n$ ;  $a = 6.005(1) \text{ \AA}$ ,  $b = 7.394(2) \text{ \AA}$ ,  $c = 6.005(1) \text{ \AA}$ ,  $\beta = 103.51(3)^\circ$ ,  $Z = 2$ , space group  $P2_1$ . Disodium tetraamidogallate amide,  $\text{Na}_2[\text{Ga}(\text{NH}_2)_4]\text{NH}_2$  ( $a = 11.748(2) \text{ \AA}$ ,  $b = 6.681(1) \text{ \AA}$ ,  $c = 9.665(2) \text{ \AA}$ ,  $Z = 4$ , space group  $Pnma$ ), was grown ammonothermally ( $p = 130 \text{ MPa}$ ,  $T = 580 \text{ °C}$ ) as single crystals in the course of synthesizing wurzite GaN employing  $\text{NaNH}_2$  as an

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