



## **Thermal cycling of GaN-on-Diamond Wafers**

By Group4 Labs Management

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## **OBJECTIVE**

This report summarizes the results of thermal-cycling experiments carried out by Group4 Labs to test the resilience of GaN-on-Diamond epitaxial wafers under extreme thermal processing conditions. The information included here has been designed to aid the reader with the use of the GaN-on-Diamond wafer for epitaxial re-growth, or device processing purposes.

The interested reader is invited to call or email Group4 Labs engineers ([technology@group4Labs.com](mailto:technology@group4Labs.com)) directly to discuss further the topics discussed in this document.

# EXPERIMENTAL DETAILS

- A compromised (poorly attached) GaN-on-Diamond wafer was selected for the thermal cycling tests demonstrated here.
- The same two locations on the wafer sample were tracked during the thermal cycling tests.
- Profiles for each thermal cycle are shown on page-4
- Thermal cycling experiments were carried out with a standard RTA equipment

# Thermal cycling profiles used in tests

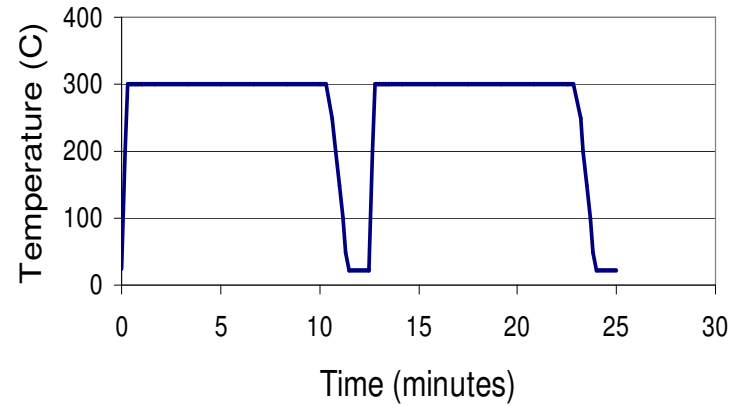
	Number of Thermal Cycles	Mins at Peak Temperature
300C	100	10-mins
500C	10	5-mins
750C	10	1-min

## Standard RTA tool

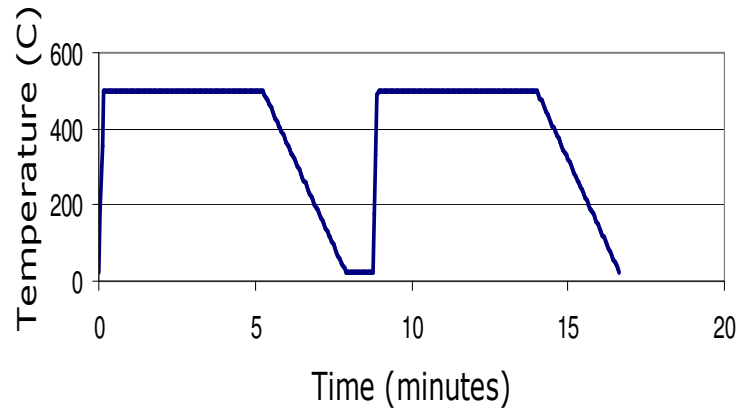
Ramp Up Time: 55°C/sec

Ramp Down Time: 1°C/sec

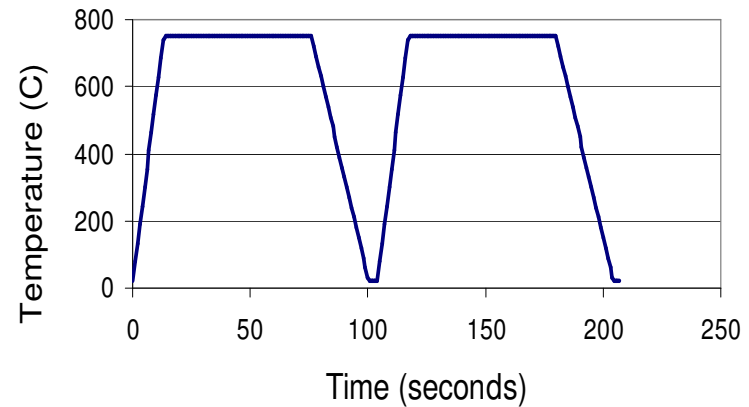
2 Cycles Shown (300C)



2 Cycles Shown (500C)

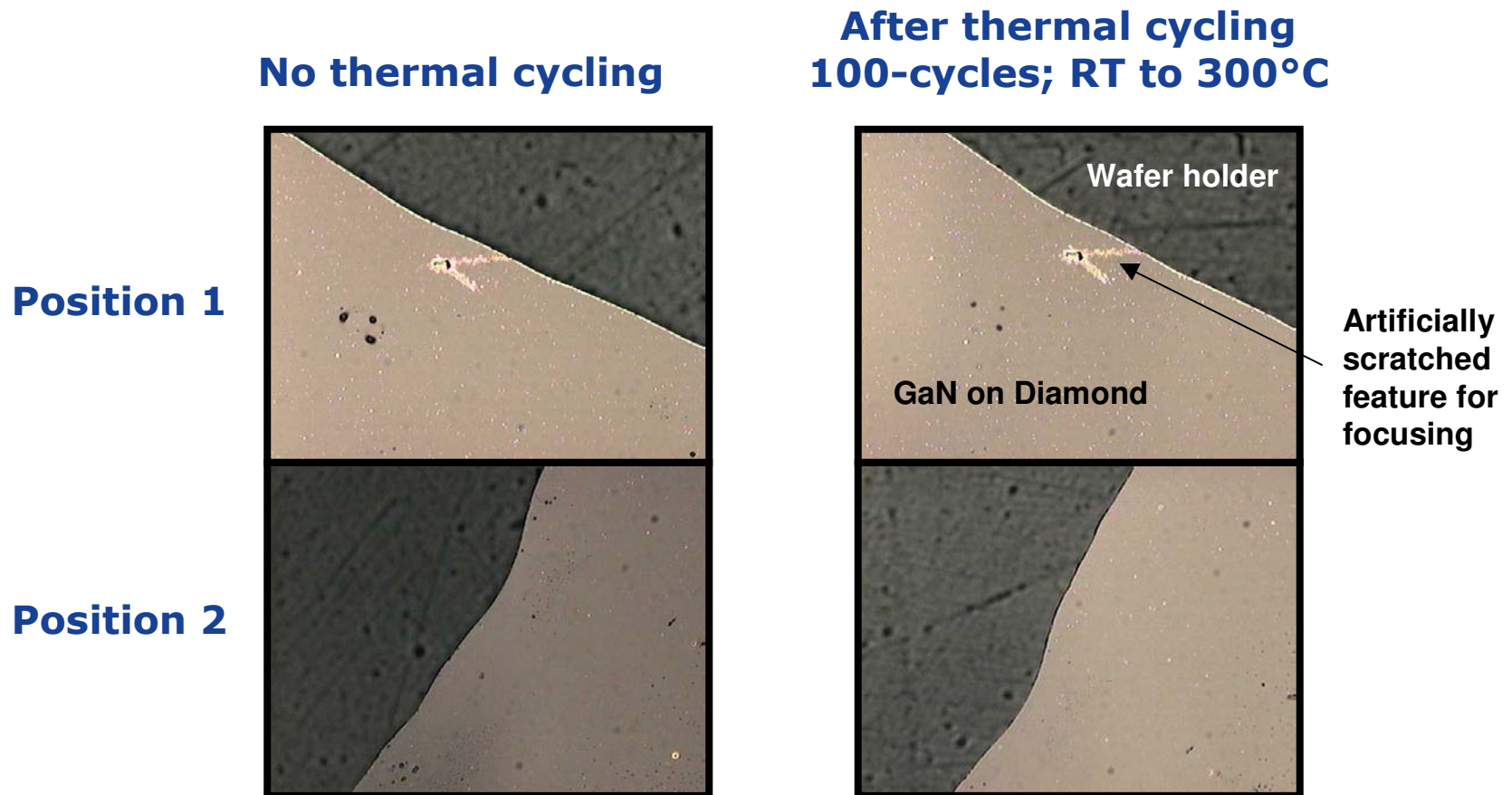


2 Cycles Shown (750C)



No changes were observed in GaN-on-Diamond wafers after 100 thermal cycles from 25°C to 300°C

## OPTICAL MICROGRAPHS (5X Objective, Top-View)



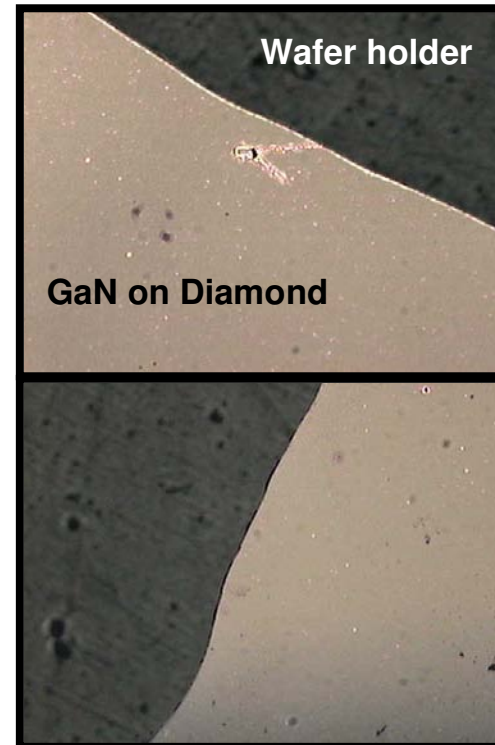
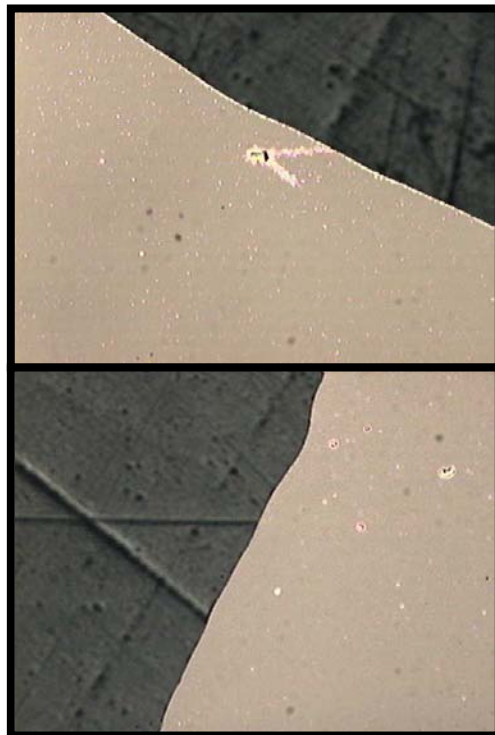
No changes were observed in GaN-on-Diamond wafers after 10 thermal cycles from 25°C to 500°C

## OPTICAL MICROGRAPHS (5X Objective, Top-View)

After thermal cycling  
1-cycle to 500°C

After thermal cycling  
10-cycles to 500°C

Position 1



Position 2

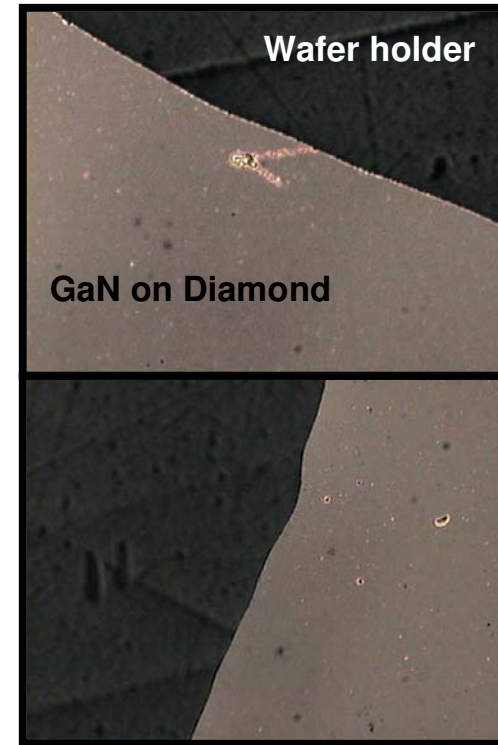
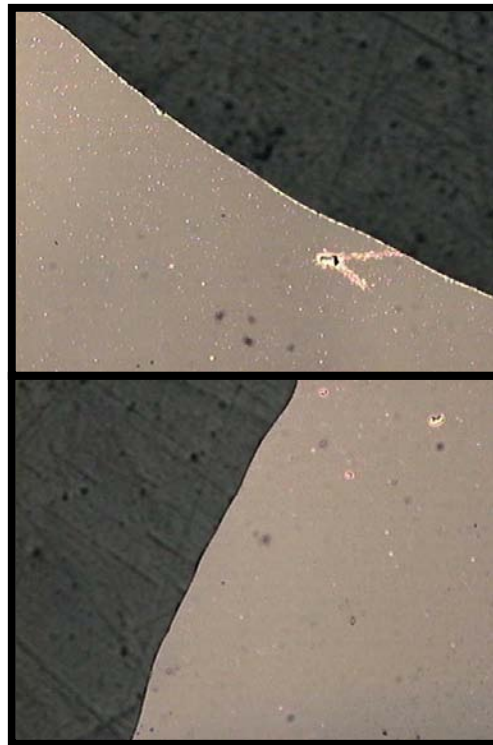
No changes were observed in GaN-on-Diamond wafers after 10 thermal cycles from 25°C to 750°C

## OPTICAL MICROGRAPHS (5X Objective, Top-View)

After thermal cycling  
1-cycle to 750°C

After thermal cycling  
10-cycles to 750°C

Position 1

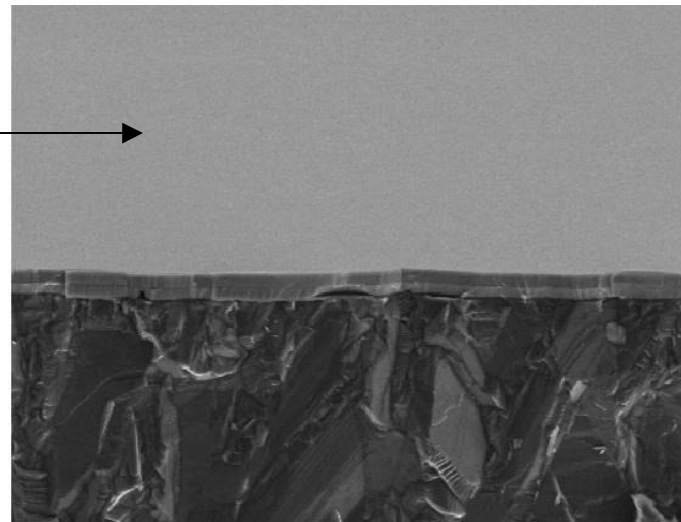


Position 2

# CONCLUSIONS

- Imperfect samples with clear evidence of poor GaN to Diamond adhesion showed no further deterioration after extensive thermal cycling up to 750°C. (*dark contrast shown in some photos are artifacts of the camera's settings – see pp. 5, bottom left; pp. 6, bottom right; and pp. 6, two right*).

**GaN Surface on Diamond  
after 10 thermal cycles  
from 25°C to 750°C**



**10- $\mu$ m**