

Cornell University
School of Electrical and Computer Engineering

Fabrication & Characterization of GaN-on-Diamond HEMTs

J. Felbinger, M. V. S. Chandra, Y. Sun and L. F. Eastman
School of Electrical and Computer Engineering, Cornell University



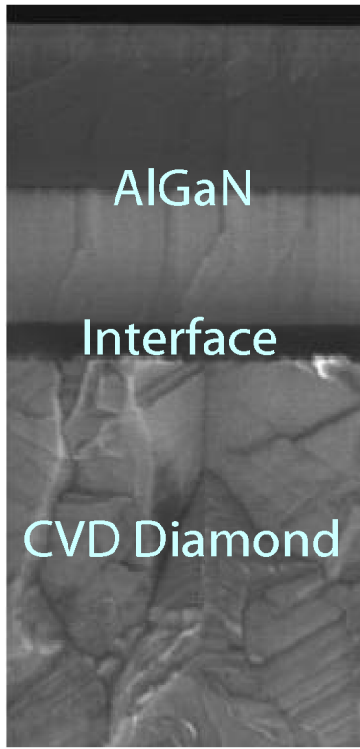
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This work is supported by Group4 Labs,
an STTR Contract from John Blevins of AFRL and MDA,
and an ONR MURI subcontract from UCSB





GaN-on-Diamond HEMT



SEM cross-section of similar material

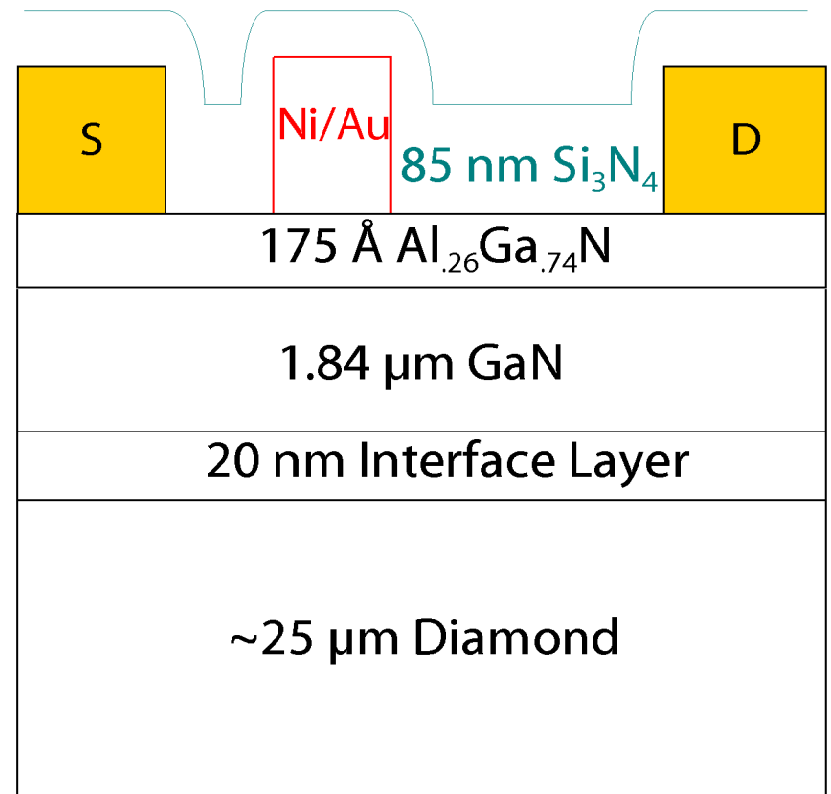
Ohmic Contacts:
Ti/Al/Mo/Au

Mesa Isolation:
ICP $\text{Cl}_2/\text{BCl}_3/\text{Ar}$ etch

Passivation:
 Si_3N_4 deposited at 375°C

Gate Periphery:
 $2 \times 125 \mu\text{m} \times 0.25 \mu\text{m}$

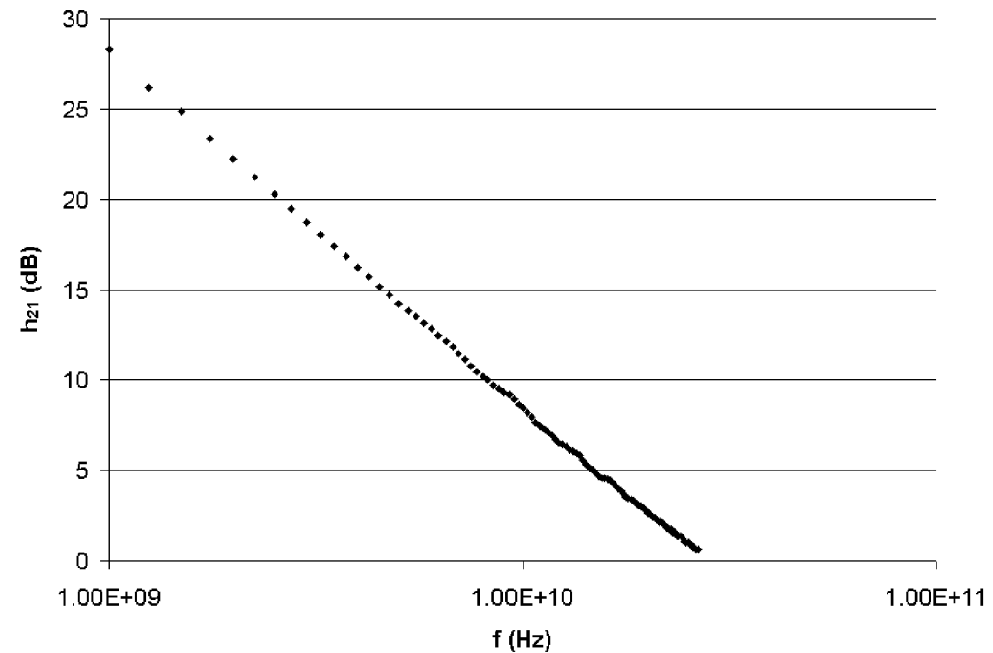
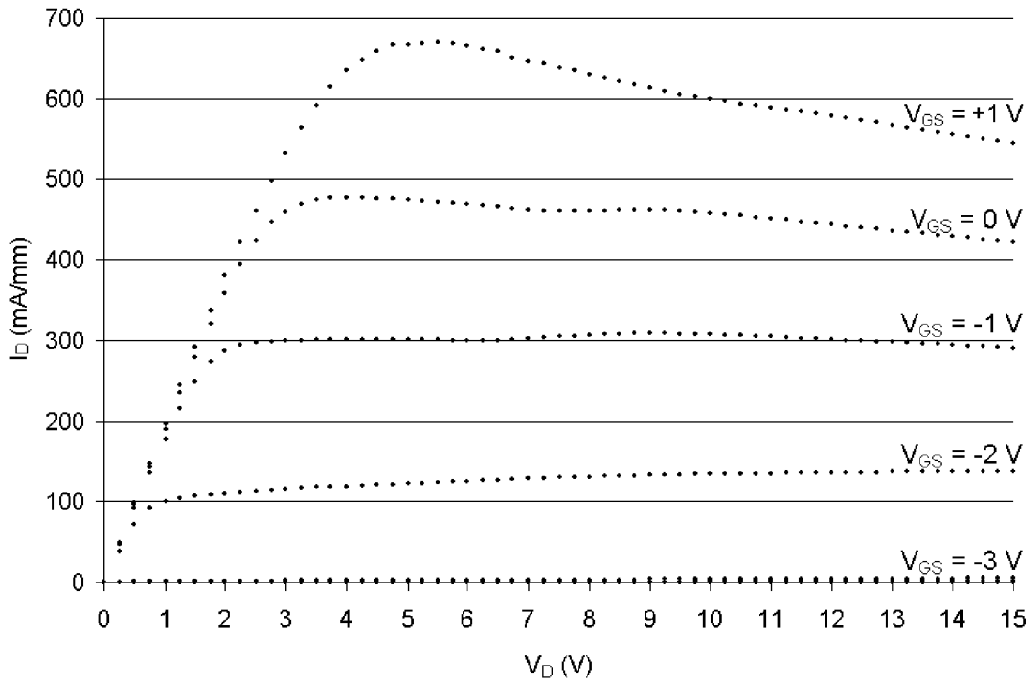
$$L_{sd} = 5.3 \mu\text{m}$$



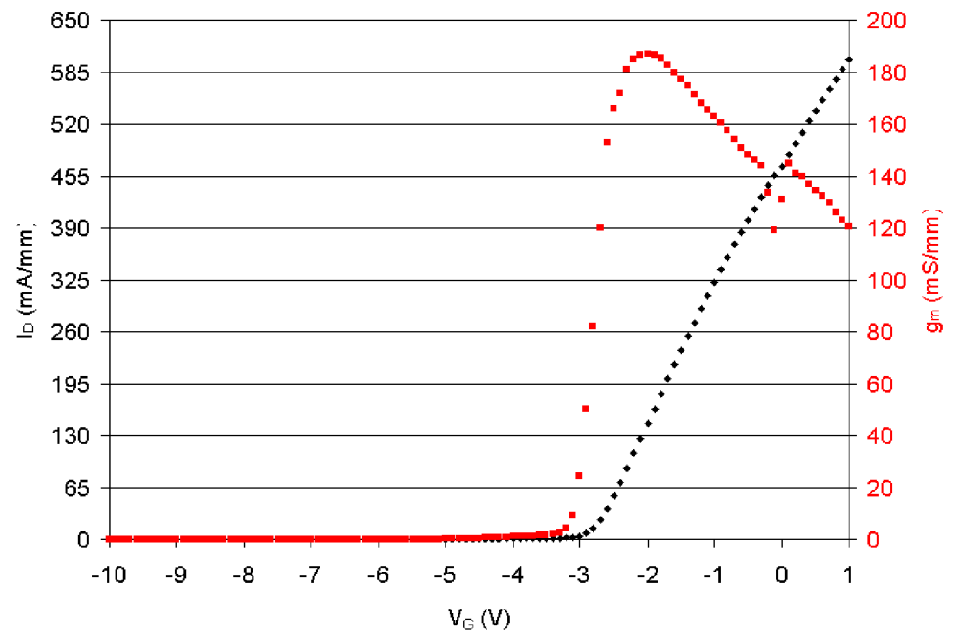
Freestanding device structure



Characteristics

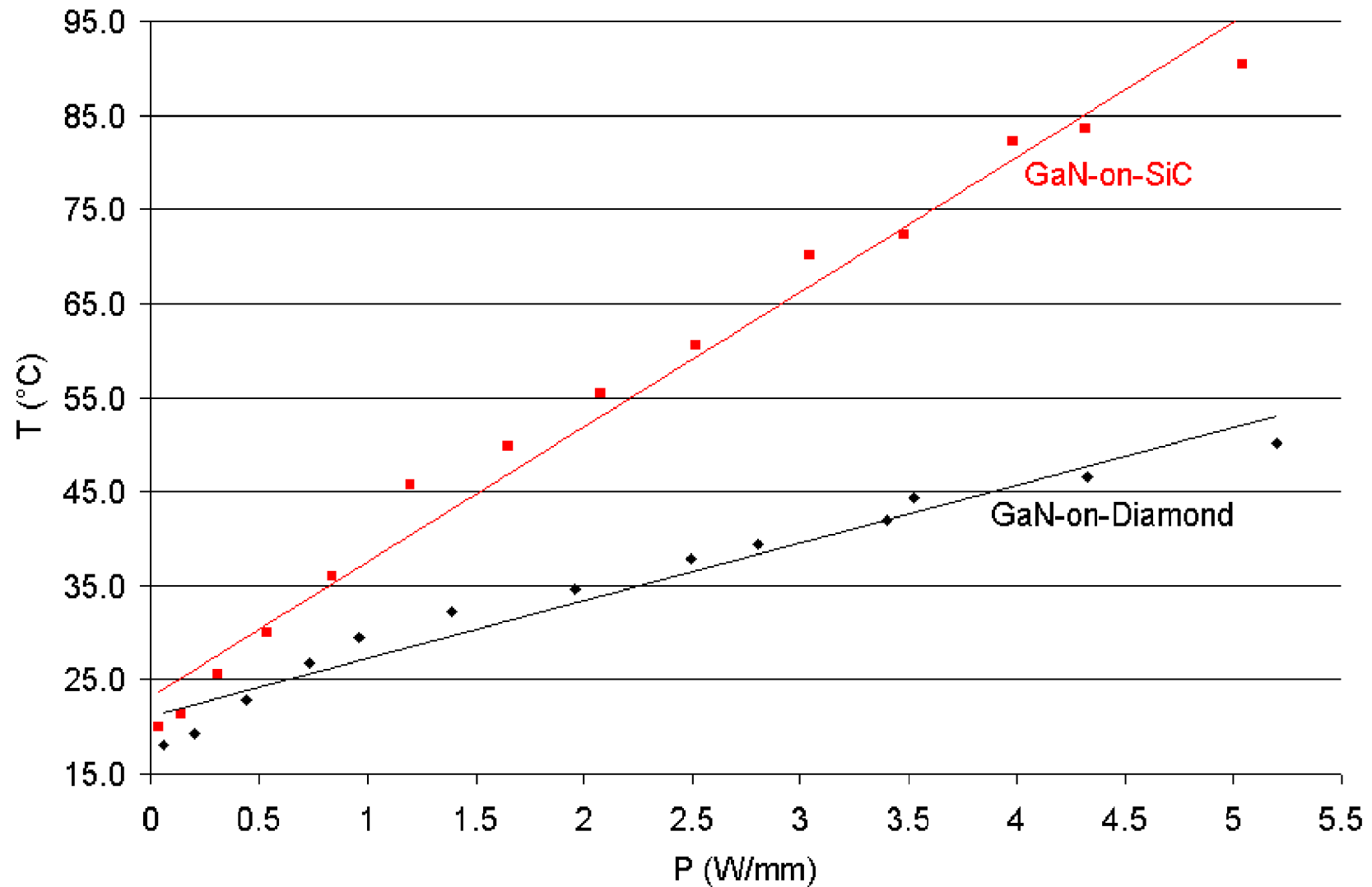


$V_p = -3.1$ V
 $I_{max} = 670$ mA/mm, $V_{GS} = 1$ V
 $g_m = 187$ mS/mm, $V_{GS} = -2$ V
 $f_t = 27.4$ GHz





Thermal Properties



Channel Temperature of Single-finger GaN-on-Diamond and GaN-on-SiC ($W_g = 100 \mu\text{m}$, $L_g = 0.25 \mu\text{m}$, $L_{sd} = 5.5 \mu\text{m}$) HEMTs



Future Work

Measure RF power performance

Measure thermal properties under 2-finger operation

Fabricate identical devices on Diamond and SiC substrates

Map thermal profile of HEMT