Record power density RF HEMT on GaN

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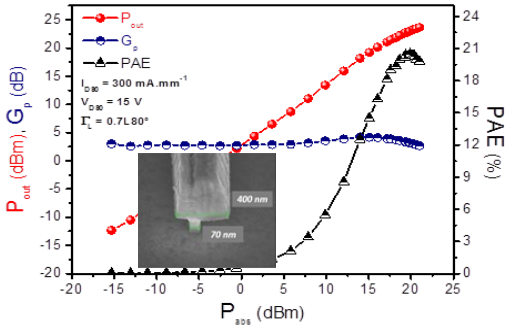

Fig 1: Output power, power gain and power added efficiency versus absorbed power at 40 GHz for a 2 × 50 × 0.07 µm² AlGaN/GaN HEMT on Free-Standing GaN substrate. The insert shows the 0.07 µm footprint gate.

A new record power density at 40 GHz on commercial GaN substrate

The development of performant and reliable GaN high-electron-mobility transistors (HEMTs) on high crystal quality GaN is hampered by the lack of large lattice matched substrates available at reasonable cost. In this context, the growth of GaN HEMTs on commercial free-standing GaN substrates previously developed for high brightness light emitting diodes has been investigated as an alternative approach for high frequency applications. After the demonstration of high quality surface despite the growth of 10 to 40 µm thick highly resistive GaN buffer layer to limit the capacitive coupling between the active regions at the top and the conductive substrate at the bottom, 70 nm gate footprint transistors have been successfully fabricated.

A 100 GHz maximum intrinsic cutoff frequency f_T, and a maximum intrinsic oscillation frequency f_{Max} of 125 GHz are obtained from S-parameters measurement. A record output power density of 2 W/mm, associated with 20.5 % power added efficiency and a linear power gain (Gp) of 4.2 dB is demonstrated at 40 GHz.

Breakthroughs

Record power density at 40 GHz on commercial GaN substrate doubles the previous state of the art.

Perspectives

Further enhance the performance by optimizing the epitaxial structure.

Collaborations : IEMN, LUMILOG, LAAS (ANR-11-LABX-0014, Investissements d'Avenir, 'GaNeX')
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