POWER ELECTRONICS

## Recess to progress

*IEEE Electron Device Lett.* http://doi.org/chb3 (2017)

The transformation and distribution of electrical power requires electronics designed for extreme conditions such as high voltages, currents and temperatures. β-$Ga_2O_3$ is an emerging power semiconductor with a wider bandgap (4.5–4.9 eV) than conventional power semiconductors like GaN (3.4 eV) and 4H-SiC (3.3 eV). Moreover, its Baliga figure of merit (a basic parameter used to determine the suitability of a material as a power device) is three times higher than that of GaN and eight times higher than that of 4H-SiC. Kelson Chabak and colleagues have now incorporated a recessed gate structure in enhancement-mode β-$Ga_2O_3$ transistors to achieve power switching figure of merits for d.c. conduction and dynamic switch losses that exceed previously reported β-$Ga_2O_3$ transistors.

The researchers — who are based at the Air Force Research Laboratory, Cornell University, George Mason University and the Tamura Corporation — enveloped the side and bottom facets of the recessed gate with 20 nm of atomically deposited $SiO_2$. This created a fully depleted channel at a gate source voltage of 0 V, leading to transistors exhibiting breakdown voltages exceeding 500 V and drain current densities of 40 mA $mm^{-1}$. Furthermore, the devices had an on-state current to off-state current ratio of $10^9$, which is a record for enhancement-mode transistors based on β-$Ga_2O_3$.

Michael Lee

Published online: 8 January 2018
https://doi.org/10.1038/s41928-017-0019-3



© 2018 Macmillan Publishers Limited, part of Springer Nature. All rights reserved.