NSYSU physics

學生研討會 Student Seminar

NATIONAL SUN YAT-SEN UNIVERSITY

Electrical Analysis and Reliability Studies of GaN HEMTs and RRAM Devices

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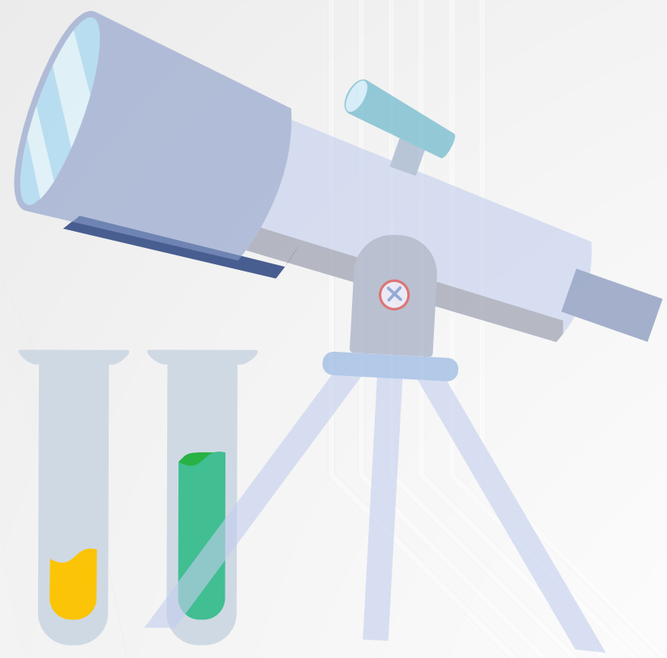
Abstract

This doctoral dissertation comprises three research topics. First, a novel method is proposed to extract impact ionization current in GaN MIS-HEMTs based on the bandgap characteristics of the AlGaN/GaN interface. The extracted behavior is validated by hot-carrier stress experiments, demonstrating its applicability to operating-point selection and reliability evaluation. Second, the electrical impact of wet-clean loop cycles on p-GaN HEMTs is investigated. Increasing the number of wet-clean cycles increases the on-state current while reducing the off-state current. A physical model is proposed and verified using Dynamic Voltage Stress tests. Third, the reliability of RRAM with different bottom-electrode structures is examined. An ultrathin TaN layer inserted between the oxide and Ru electrode effectively reduces the forming voltage, but introduces a trade-off with device reliability. The underlying mechanisms are systematically analyzed to provide guidelines for optimizing RRAM electrode structures.



Designed with help from Vecteezy