Microfabrication and Characterization of AlGaAs/GaAs Heterojunction Bipolar Transistors (HBTs)

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Abstract (in 12 Pt Arial Font)

This presentation reports development of AlGaAs/GaAs HBTs. Semiconductor processing techniques, such as photolithography, wet etching, sputtering, E-beam evaporation, PECVD and RIE, are used to realize the mesa structures of HBTs. Metal layers are deposited by E-beam evaporation and patterned by a photoresist lift-off process. Emitter, base and collector are formed by wet or dry etching. Dielectric layers are deposited by high-density plasma and patterned by RIE. Because it is critical to obtain high-quality ohmic contacts on thin p-type bases, a comparative study is conducted on the influence of three barrier metals, Ni, Pt, and Pd, on the AuBe contact resistance and stability. Au-induced spiking is a great concern when the base layers are thin (< 1000 Å), and a thin AuBe layer of 400 Å is used in this research to limit the amount of Au so as to prevent the occurrence of deep Au spikes. In the same time, the thin AuBe layer also helps prevent excessive Be atoms from diffusing into the base layers, which may cause a change in the base thickness and a location shift of the b-c junction. AuBe is found to lack sufficient adhesion on GaAs, and a large proportion of AuBe contacts are lost during a photoresist lift-off process. A thin Ti layer is used to enhance adhesion, and its effect on the AuBe ohmic contact resistance is investigated. The HBTs exhibit excellent linearity with low offset and knee voltages.

Biography of Presenter (in 12 Pt Ariel Font)

Xu received his B.S. degree from Harbin Institute of Technology in China in 1989, his M.S. degree from Beijing University of Science and Technology in 1992, and his Ph.D. degree from University of California, Irvine in 2000, all in materials science and engineering. He worked as an engineer in the Chinese Academy of Science Mechanics Institute and the Chinese National Engineering Center of Composites, both in Beijing, China, and the RF Integrated Corporation in California. His early experience includes structural materials (light alloys and refractory metals), engineering functional materials (hard/soft magnetic materials, hydrogen-storage materials for rechargeable battery and non-lead soldering materials) and thin films. His recent experience is mainly on semiconductor materials and processing, III-V compound device passivation, high-speed transistor (HBTs and HEMTs) processing and characterization, and MEMS. His current interests focus on solving the reliability issues in RF MEMS switches and III-V compound transistors as well as developing novel nano-layered and nanostructured materials.