Laser Annealing: A New Strategy For SiC Power Device Contacts

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Reduce the environmental footprint of human ac3vity has become a necessity, as expressed in the Paris agreements in 2015 (COP21). Hence, governments must turn their aEen3on to more respecF ul and responsible energy consump3on. To achieve the objec3ves of greenhouse gas emiss ion reduc3on, key resolu3ons focus on improving the energy efficiency of electri cal systems and the electrifica3on of mobility. Development of new semiconductors for po wer applica3ons, that improves power efficiency compared to silicon, is a key issue in this context. It has been largely driven by Electrifica3on of Vehicles (EV). Silicon carbide (SiC) is certa inly the wide bandgap semiconductor, working under a high temperature and po wer, that beEer address these ques3ons, with gallium nitride (GaN) as compe3tor. Two w idespread elementary devices, Junc3on Barrier SchoEky (JBS) diodes and MOSFET trans istors, are the heart of any SiC power systems. They are built in the well- established 4H-S iC polytype and these SiC power systems are found in most of the famous EV brands.
Nevertheless, improve quality, reliability and efficiency of the power systems is needed and conta cts on SiC devices is one of the major milestones.

JBS diode is an ideal test vehicle to develop those milestones. In this work, we review recent progresses on SchoEky and ohmic contacts currently used in 4H-SiC devices. To reduce substrate contribu3on to the R_{ON} in ver3cal topologies and improve JBS power efficiency, new genera3ons of 4H-SiC devices are fabricated on thinned wafers. However, using such thinned wafers has a large impact on fabrica3on process flow of the device. Indeed, in ver3cal devices, the backs ide ohmic contact, that is obtained using Rapid Thermal Annealing (RTA) at high temperature, is no more a solu3on. In the last years, device improvement, that have required large process modifica3ons, passed using Laser Thermal Annealing (LTA). Indeed, LTA is the unique solu3on to fabricate ohmic contact with the required low s
ubstrate temperature eleva3on at the end of the process flow.

In the presenta3on, we will present the recent advances on LTA for SiC ver3cal devices. We will emphasise how to beEer understand ohmic contacts using TCAD simula3ons and going up to their physical characteriza3on and electrical performance consecu3ve to laser irradia3on.