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Aluminum metallization

In high power electronics one of the major interests in the recent years has been to increase the general component reliability. With regards to power modules this has primary been centered on semiconductor devices and device interconnects. A common issue in converters is losing connection to active components like transistors.

Here the semiconductor chip metallization is a crucial element to maintain connection to all parts of the chip. In Figures 1a and 1b a topographic view of the metallization on a power diode and IGBT chip is illustrated. Images of a similar sample subjected to so-called active cycling are presented in Figures 2a and 2b. While the IGBT metallization remains intact and functioning, the diode metallization show a clear tendency of material reconstruction. This is a problem needing additional investigation to fully understand. The primary project assignments are the following:

1. Fabrication of thick Al film (>500nm) on Si substrates and compare to industrial standard Al metallization on power diodes.
2. Investigate metallization robustness by subjecting the sample to passive thermal cycling and analyzing the degradation mechanism. The main characterization methods needed are optical microscopy, SEM/FIB (EDX), and XRD.
3. Investigate the state of a metallization on a real device which has been subjected to real world stresses and compare to test devices.

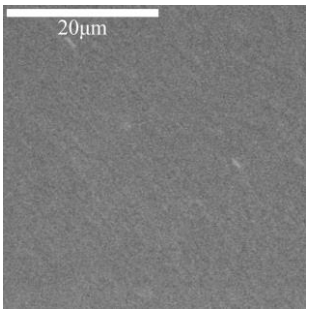

Figure 1a: Diode metallization in new power module.

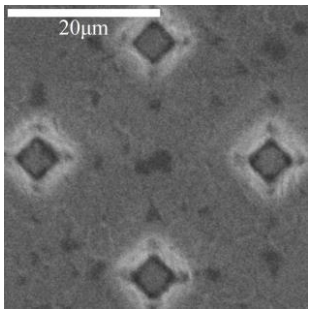

Figure 1b: IGBT metallization in new power module.

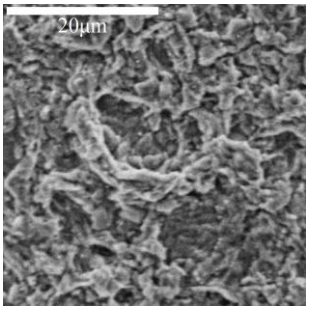

Figure 2a: Diode metallization in power module subjected to active cycling.

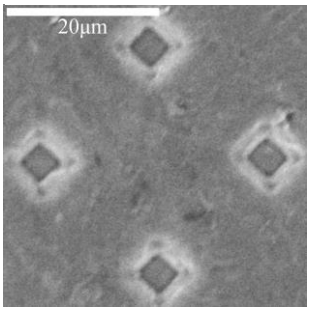

Figure 2b: IGBT metallization in power module subjected to active cycling.