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Temperature Characteristics of 4H-SiC LDIMOSFET fabricated on an on-axis HPSI substrate

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Abstract:

In this paper, we present the temperature characteristics of the 4H-SiC lateral double implanted metal-oxide-semiconductor field effect transistor (LDIMOSFET) fabricated on an on-axis high purity semi-insulating (HPSI) substrate without using epi-layer. To avoid the surface roughness and polytype inclusion problem, on-axis semi-insulating substrate is used to fabricate the device without growing an epitaxial layer. The characteristics of the device have been verified by simulation with the use of 2-D device simulator, Silvaco ATLAS, and experimentally.

The fabricated device adopted current path layer (CPL) instead of an epi-layer. At a forward bias condition, the CPL serves as a current path of the device, and at reverse bias condition, it serves to support the breakdown voltage. Therefore, CPL is very important to obtain appropriate MOSFET characteristics. However, there are so many deep traps such as Z1/2, EH6/7 within the semi-insulating substrate. And these kinds of deep traps affect the device characteristics with temperature. Especially, the forward characteristics of the device were strongly affected by temperature. So, in this paper, we analyzed the forward characteristics of the device as a function of temperature. And, the effect of deep traps within the semi-insulating substrate also analyzed.

Unlike the conventional LDIMOSFET, due to the deep traps within the semi-insulating substrate, the current characteristics of the device fabricated on the semi-insulating substrate tend to increase as the temperature increases. We will discuss the detailed effects of the device parameters and deep traps on the -I-V characteristics at the manuscript.

Keywords

4H-SiC, LDIMOSFET, Semi-insulating, Temperature characteristics, Deep traps

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