Simulation for SiC Power Electronic Device Developments

Project Representative

Toshiharu Ohnuma

Central Research Institute of Electric Power Industry

Authors

Toshiharu Ohnuma[*1], Atsumi Miyashita[*2], Masahito Yoshikawa[*2], Hidekazu Tsuchida[*1],

Misako Iwasawa[*3]

＊1　Central Research Institute of Electric Power Industry

＊2　Japan Atomic Energy Agency

＊3　Japan Agency for Marine-Earth Science and Technology

Abstract

Silicon carbide (SiC), being a wide-band-gap semiconductor, is an attractive material in the development of electronic devices operated under extreme conditions such as high power, high temperature, and high radiation. SiC is particularly attractive for use in metal-oxide-semiconductor (MOS) technology because among the compound semiconductors only silicon carbide has the thermal oxide SiO_2, which is a good insulator. However, it is known that SiO_2/SiC interfaces have a higher density of interface traps than SiO_2/Si interfaces and that the channel mobility of MOS devices is much lower than theoretically expected values. In order to improve these characteristics, it is important to understand the thermal oxidation process at the SiO_2/SiC interface. In this report, we performed large-scale first-principles molecular dynamics simulations of the SiO_2/SiC interface oxidation process and the NO annealing. We also performed large-scale first-principles molecular dynamics simulations to generate amorphous SiO_2/SiC interface and calculated interface states using hybrid functionals.

KeyWords: First-principles molecular dynamics simulation, SiC power device, interface, thermal oxidation