EPR Studies of SiC/SiO_2 Interfaces in n-type 4H and 6H Oxidized Porous SiC

J.L. Cantin[1], H.J. von Bardeleben[1], M. Mynbaeva[2], S.E. Saddow[3], Y. Shishkin[4], R.P. Devaty[4], and W.J.Choyke[4]
[1]Groupe de Physique des Solides, Univ. Paris 6, CNRS 2, place Jussieu, 75005 Paris
[2]A.F. Ioffe Institute, Polytechnicheskaya 26, St. Petersburg, Russia
[3]Electrical Engineering Department, University of South Florida, Tampa, Florida, USA
[4]Department of Physics, University of Pittsburgh, Pittsburgh, PA, USA

The oxidation of SiC and the nature of the interface have been widely studied in the past due to their fundamental interest and applications in MOSFET structures, but many questions concerning the oxidation mechanisms and interface formation with its related defects are still unsettled. The oxidation process of SiC is more complex than in its well known counterpart Si/SiO_2 due to the role of C and the polar nature of the compound.

For interface and oxide defect studies the EPR (electron paramagnetic resonance) technique has shown its strength in the case of Si/SiO_2, but the results on SiC/SiO_2 are still very incomplete. The microscopic nature of the defects, the presence of which is known from electrical measurements, is still unknown due to the absence of related EPR spectra.

We have very recently shown (1) that the use of oxidized porous SiC can improve the experimental situation due to the increased internal surface area. We have found evidence for two paramagnetic defects, which we attribute to an interface dangling bond center and an oxide volume defect.

We report here an extension of the previous work from n-type 4H to n-type 6H porous SiC, including higher frequency (35GHz) and low temperature measurements.

We obtain essentially similar EPR spectra in the 6H polytype as in 4H material. Superhyperfine interaction with the Si neighbor shells is directly resolved in the EPR spectra.

The electrical properties of the interface defects are analyzed from the electrical compensation of the SiC and the related below bandgap photoconductivity.

1. H.J .von Bardeleben et al., Proc. of the ECSCRM Meeting, Linköping 2002, Materials Science Forum, to be published (2003).