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Evolution of the EELS spectra across the interface of 4H-SiC/SiO₂ metal-oxide-semiconductor field-effect transistors processed by different methods*

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The interface between 4H-SiC and SiO₂ in metal oxide semiconductor field effect transistor (MOSFET) devices contains a high density of electrically active defects even though the interface is very sharp. The defects adversely affect the performance of microelectronic devices by lowering the electron mobility at the interface compared to that of bulk SiC. Furthermore, the charge mobility of these devices is greatly affected by the process used for deposition, or growth, of the oxide as well as any post oxidation process. The most prevalent treatment is a nitric oxide (NO) post-anneal which gives rise to increase in the interface mobility. In addition, devices fabricated on different crystallographic faces of SiC, or with varying miscut at the interface show markedly different electronic performance. Post oxidation annealing in NO has shown improved channel mobility, increased N interfacial density, and decreased charged interface trap density. We present a systematic analysis of the chemistry and structure of the oxide/SiC interface by monitoring the change in the fine structure of the Si-L_{2,3}, C-K and O-K edges in the electron energy loss spectra within a few nanometers of the interface of devices processed by different methods. Our results indicate that the Si-L_{2,3}, C-K and O-K change at the interface indicating a different chemical structure within this region.

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Biography:

Lourdes Salamanca-Riba is a Professor in the Materials Science and Engineering Department at the University of Maryland. Her research is in the areas of nanomaterials, self-assembly in semiconductor nanostructures, hybrid photovoltaics, solid oxide fuel cells and carbon nanostructures in metals called covetics. Her research focus is on the synthesis and characterization of materials using transmission electron microscopy. She has a BS degree in Physics from the Universidad Autónoma Metropolitana in Mexico City and a PhD degree also in Physics from MIT. She was a Senior Research Scientist at the GM Research Laboratory in Warren, MI prior to becoming a faculty member at the University of Maryland. Professor Salamanca-Riba has over 140 publications and is a member of the Materials Research Society, American Physical Society and the Microscopy Society of America.