Amazing Nano-Objects and Nanochemistry at Silicon Carbide Surfaces

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Silicon carbide (SiC) is a wide band gap IV-IV compound semiconductor having a strong interest in advanced electronic device/sensor applications, in nanotechnology and as a biocompatible material. Cubic and hexagonal SiC surfaces are investigated by i) variable temperature atom-resolved scanning tunneling microscopy-STM and spectroscopy-STS (electrons/photons), ii) synchrotron radiation-based core level/valence band photoemission spectroscopy, iii) grazing incidence x-ray diffraction and iv) infrared absorption spectroscopy. Among some of the results, the following ones will be presented and discussed:

- Massively parallel self-organized Si and Ag/Si passive/active nanowires having exceptional characteristics
- Temperature-induced semiconducting to metallic reversible surface phase transition
- $sp \rightarrow sp^3$ diamond-type surface transformation
- sp^2 surface transformation and subsequent epitaxial graphene formation and its electronic properties
- The first example of H/D-induced semiconductor (clean and pre-oxidized) surface metallization with an amazing isotopic effect
- Atomic scale oxygen initial interaction

All these characteristics are unprecedented. They show novel aspects with SiC ability to be a very promising material in nanoscience and exciting for interfacing with biology.