From Micro to Nano Scales and Nanochemistry at Advanced Materials: Electronic Applications and Electric Propulsion in the Space

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The Moore's law has powered the information-technology revolution since the 1960s. Due to new needs and challenges, it is approaching its end [1]. Thermal transport is now a major issue, especially at low-dimensional scales [1,2]. Silicon carbide (SiC) & graphene are advanced semiconductors. SiC is especially suitable for high-temperatures, high-power, high-frequencies devices/sensors. Atomic lines, nanotunnels and selective nanochemistry are grown/developed at its surfaces and sub-surfaces [3-5]. Epitaxial graphene grown on SiC exhibits outstanding figures of merit with unsurpassed charge transport properties & spin diffusion lenght, and the highest thermal conductivity [6-8]. Furthermore, hydrogen atoms interacting with epitaxial graphene on SiC appears as a possible route toward prebiotic life in the universe [9]. These aspects are investigated theory & synchrotron radiation-based photoemission, photoelectrons & X-rays diffraction and atom-resolved scanning tunnelling microscopy & spectroscopy (STM, STS) [3-5,9].

Electric propulsion is developed for advanced spatial applications (NASA, USAF, AIRBUS DEFENCE & SPACE). It requires materials able to operate in extreme environments, with low work function & high electronic emissivity as LaB6. Eutectics-based on LaB6 with embedded ZrB2 fibers (Ø ≈ μm) trigger an additional significant lowering of surface work function and a subsequent electronic emission increase [10,11]. Their structure and properties are investigated by LEEM, PEEM & ThEEM state-of-the-art microscopy [12].

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