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Editorial

Optical and Quantum Electronics: Physics and Materials

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The field of optical and quantum electronics (OQE) is a pillar of current technology and scientific development. The generation, control, and detection of electromagnetic radiation in the submillimeter regime (terahertz, infrared, visible, and ultraviolet) have become ubiquitous in devices used every day and in research laboratories. The interaction of electromagnetic radiation with matter at semiclassical and quantum level is a founding block on which our current understanding and development of OQE rely on [1–3]. To a large extent, the technological evolution shall evolve depending on the progress on this field, which comprises an ample portfolio not only about the physical phenomena of 3D and lower dimensionality materials [4–6] but also about the applications involving the generation and detection of electromagnetic radiation, in addition to the study of light-probed physical properties, where quantum phenomena play a central role.

This Special Issue of *Inorganics* collects research articles and reviews on optical and quantum electronics comprising advances in the properties and performance of a wide range of materials. These include theoretical calculations of electronic and phonon properties, experimental results on low-dimension materials such as nanowires, atomic clusters, Langmuir–Blodgett films, heat and charge transport including hot carriers, applications of photonic upconversion, and results on devices such as transparent RRAMs and perovskite solar cells.

Currently, perovskites are a class of materials highly relevant for a good number of applications. Elucidating their properties has become a major task for device design. In particular, surface and interface phenomena can determine their performance. In ABO_3 perovskites, there are serious issues related to surfaces. R.I. Eglitis et al. [7] present a comparison of density functional theory calculations for B3PW and B3LYP exchange-correlation functionals for the neutral (001) and polar (111) surfaces of ABO_3 surfaces (A = Ba, Sr, Pb, Ca; B = Sn, Ti, Zr). They found different types of relaxations for the near-surface atomic layers and specific terminations. It was found that the calculated band gaps for the bulk were generally reduced near the neutral (001) and polar (111) surfaces.

Zincblende group-IV binary XC and ternary $X_xY_{1-x}C$ alloys (X, Y ≡ Si, Ge, and Sn) are of scientific and technological interest as promising alternatives to silicon for high-temperature and high-power applications. Efforts have been made to calculate the structural, electronic and vibrational properties of binary alloys, although no vibrational and/or thermodynamic studies have been conducted on ternary alloys. D.N. Talwar [8] employed a rigid-ion model to account for the lattice dynamics and thermodynamic properties of both binary and ternary alloys. Positive values of the acoustic modes in the entire Brillouin zone implied structural stability of the XC binaries. The case of ternary alloys was addressed through Green's function theory in the virtual crystal approximation to calculate composition-dependent phonon frequencies ω_j (**q**), including the one-phonon density of states. It was concluded that devices based on GeC, SnC, and/or $Ge_{1-x}Sn_xC$ may

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not be appropriate for radiation detection in nuclear reactors or high-temperature, high-power settings. However, ultrathin XC binary and $X_{1-x}Y_xC$ ternary alloys can be suitable for heterostructures in MQW and SL-based micro/nanodevices for different strategic and civil applications.

The search for efficient transparent conducting oxides is one of the main research areas in materials science. The applications of these materials depend on the high demand for present and future applications. These include high-resolution screens for portable computers, flat-screen high-definition televisions, low-emissivity and electrochromic windows, the manufacture of thin-film photovoltaics, and an increasing demand of smart displays for hand-held devices [9–14]. Silver nanowires (AgNWs) are considered a potential alternative to conventional transparent conductive materials for a wide range of applications. H. Ha et al. [15] review the incorporation of polymeric materials to AgNW electrodes with an emphasis on their protective performance as well as on their applications. This review includes an evaluation of relevant factors that may affect compatibility with AgNWs and a perspective of challenges and opportunities to overcome current drawbacks with emerging technology.

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