ΠΑΝΕΠΙΣΤΗΜΙΟ ΚΡΗΤΗΣ
ΤΜΗΜΑ ΕΠΙΣΤΗΜΗΣ ΚΑΙ ΤΕΧΝΟΛΟΓΙΑΣ ΥΛΙΚΩΝ

ΠΑΡΟΥΣΙΑΣΗ ΜΕΤΑΠΤΥΧΙΑΚΗΣ ΔΙΠΛΩΜΑΤΙΚΗΣ ΕΡΓΑΣΙΑΣ

Τίτλος

«Synthesis of 2D Halide Perovskites for Optoelectronic Applications»

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Επιβλέπων καθηγητής: Κωνσταντίνος Στούμπος

Τρίτη 26/10/2021

16:00

Η παρουσίαση θα πραγματοποιηθεί στην **αίθουσα Α210 του Τμήματος Μαθηματικών και Εφαρμοσμένων Μαθηματικών,** του Πανεπιστημίου Κρήτης.

ABSTRACT

The three-dimensional (3D) hybrid organic−inorganic perovskites AMX_3 have shown huge potential for use in solar cells and other optoelectronic devices in the past decade. More recently, two-dimensional (2D) perovskite derivatives have been shown to expand the field into a more diverse subgroup of high-performance semiconducting hybrids that possesses unique photophysical properties. In particular, because of the negligible contributions to the frontier orbitals from the organic cation and to the absence of orbital overlap between the metal-halide layers, electron and hole wave functions are confined within the crystallographically ordered 2D inorganic sublattice, resulting in a natural, multiple quantum-well electronic structure. As a result, the hybrid 2D perovskites are subject to quantum confinement, which leads to an increase in the optical band gap, but, in addition, they are also subject to coulombic screening of the photo-generated electron−hole pairs due to the large dielectric contrast between the organic and inorganic components. The latter feature give rise to a huge =exciton binding energies of ~ E_b = 200-500 meV, which is ∼10 times larger than k_BT thermal energy at room temperature.

The present Thesis deals with the crystal chemistry of these materials and attempts to address important questions in the field. The first part of the Thesis deals with the crystal growth of 2D Ruddlesden-Popper-type perovskites $(BA)_2(MA)_{n-1}Pb_nI_{3n+1}$ (BA^+ = $CH_3(CH_2)_3NH_3$, MA^+ = CH_3NH_3; n=1-4) of suitable spatial dimensions and optical quality for use in distributed Bragg reflectors (DBRs) microcavities, towards polaritonic applications. The second part concerns exploratory synthesis of $APbBr_4$ (A^{2+} = piperidinium-based ammonium dications) 2D Dion-Jacobson type perovskites, in which the heavy lattice strain introduced by the asymmetric organic cations can lead to broadband emission caused by self-trapping of the exciton and producing efficient, single-component white-light emitters during the process.