**סמינר כימיה פיסיקלית ואנליטית**

## יום ד' 17.08.2022 שעה 10:30

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נושא:

"Exposing the growth mechanism of IV-VI semiconductors with various morphologies.

Photo-physical characterization upon layered lead halide perovskites doping."

This research was conducted under the supervision of

Prof. Efrat Lifshitz

ההרצאה תתקיים בחדר סמינרים הפקולטי

Title: Exposing the growth mechanism of IV-VI semiconductors with various morphologies. Photo-physical characterization upon layered lead halide perovskites doping.

**Abstract:**

Semiconductor colloidal nanoparticles have been extensively studied in various scientific and technological fields. Because of the variable bandgap depending on size, shape, and composition. These structures are composed of inorganic elements like the IV-VI groups or a combination of organic and inorganic elements like layered lead halide perovskite. The wet chemical approach is a simple and reproducible method for controlling nanoparticle size, shape, and composition.

The first section of the thesis discusses using a wet chemical approach to synthesize the IV-VI groups (PbS) nanostructures. By controlling the synthesis conditions, we could produce quantum dots, discs, ribbons, and star-shaped structures. The control of size and morphology is discussed, and their physical and optical properties in the near-infrared regime are investigated. This section delves deeply into the branched structure's growth mechanism. We are demonstrating the importance of surfactants in the branching process. This research provides fundamental knowledge for the design of other branched semiconductor structures. These nanostructures are very appealing for telecommunications and light harvesting applications.[1][2]

Layered metal halide perovskite (LMHP) materials have received much attention in the past decade due to their fascinating physical properties, including tunable optical bandgaps, high absorption coefficients, and high carrier mobilities. In addition to their low-cost preparation and increasing energy conversion efficiency. The multiple-quantum-well structure of layered lead halide perovskites is expected to improve excitons-dopant interaction.[3] The second section of the thesis explores doping of (PEA)2PbI4 (PEA: Phenethylamine) layered perovskites. The dopants under consideration are rare earth ions: Tb3+, Er3+, and Yb3+ with d-f and f-f transitions inside the perovskite bandgap. Doping is accomplished through a simple solution process followed by structural, morphological, and chemical analysis. We investigate the photo-physical and structural changes upon doping with rare-earth elements.

[1] Jang, Y., Shapiro, A., Horani, F., Abu-Hariri, A., & Lifshitz, E. (2018). Recent Advances in Colloidal IV-VI Core/Shell Heterostructured Nanocrystals. *The Journal of Physical Chemistry C*, *122*(25), 13840-13847.

[2] Abu-Hariri, A., Budniak, A. K., Horani, F., & Lifshitz, E. (2021). Star-shaped colloidal PbS nanocrystals: structural evolution and growth mechanism. *RSC advances*, *11*(49), 30560-30568.

[3] Tan, Z., Li, J., Zhang, C., Li, Z., Hu, Q., Xiao, Z., ... & Tang, J. (2018). Highly efficient blue‐emitting Bi‐doped Cs2SnCl6 perovskite variant: photoluminescence induced by impurity doping. *Advanced Functional Materials*, *28*(29), 1801131.