סמינר מחלקתי – הנדסת חומרים

הנך מוזמן בזאת לסמינרים אשר יתקיימו ביום ה', 13 ביוני 2019, י' בסיון תשע"ט
בשעה 14:00, בניין 51 חדר 15 (באודיטוריום)

Silicon Doped GeTe as a Thermoelectric Material

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As the world progresses and technology develops, the need for alternative energy increases. This energy is created using different materials and properties to produce renewable energy and more efficient power sources that reduce the emission of carbon dioxide or any other gasses that harm the environment. Thermoelectric materials play a large role in increasing the efficiency of internal combustion engines and creating stable power banks for communities without electricity, army soldiers, and space applications. Thermoelectric materials' ability to transform thermal differences into electrical potential and vice versa grants vital opportunities to improve devices and create alternative energy. Understanding the effects of silicon on the GeTe matrix is a precursor for the further advancement of GeTe-based thermoelectric materials. The transport properties of silicon doped GeTe, and silicon atoms' effect on the GeTe matrix, have not yet been investigated. The doping process is highly complex due to the high melting point of silicon and low sublimation point of tellurium. Therefore, this research focuses on developing GeTe with 0.1at% Si by combining different stoichiometric variations of Ge_xSi_{1-x} master alloy with GeTe using low temperature techniques. The combination is done by rocking furnace melting followed by a thermal treatment. The Seebeck coefficient, thermal conductivity and electrical conductivity are measured independently to calculate ZT.

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Multifunctional devices for the regulation of cytotoxic activity of natural killer cells

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Innate immune system is based on natural killer (NK) cells, whose immune activity is regulated through a delicate balance among signals delivered by a multitude of activating and inhibitory receptors. However, the exact mechanism of how different receptors integrate their signals, and in particular how their signal integration depends on the receptor spatial organization, is unclear.

In the recent years, biomimetic devices that control spatial organization of receptors within the cell membrane have been extensively used to study how the receptor spatial order regulates cell function, including that of immune lymphocytes. Yet, these devices have been limited to control only receptor of one type, and thus could not been used to study signal integration between different receptors.

Here, we realized two types of biomimetic devices for the spatial control of inhibitory and activating receptors, whose signal integration is currently a subject of intensive study. The first type is based on photolithographically patterned lines of Ti and Au, orthogonally functionalized with activating and inhibitory ligands. Such devices spatially determine the micro-clustering of both receptors within the cells. The second type of devices is based on pairs of sub-10 nanodots of Au and Ti fabricated by nanoimprint lithography, sequential angle evaporations of the two metals, and liftoff, which were then selectively, functionalized different ligands.

Besides the used nanofabrication and functionalization approaches, we will present preliminary results of the study of NK cell immune response to various arrangements of ligands. This work provides a unique toolbox for the spatial control of diverse receptors within the cell membrane, that paves the way to numerous studies aimed at elucidating the molecular mechanism of signal integrating in cells, with the complexity and resolution impossible up to date.

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