סמינריון

הנך מוזמן/ת להרצאה סמינריונית של הפקולטה להנדסת מכונות שתתקיים ביום ד' 27.01.2021

(י"ד בשבט, תשפ"א), בשעה 18:00 באמצעות הזום :

https://technion.zoom.us/j/98636170523

מרצה : שחר ארז

מנחה : פרופ'/ח גלעד יוסיפון

מנחה שותף : פרופ' ג'וזף וואנג (UCSD)

על הנושא:

Electrical Propulsion and Cargo Transport of Micro-Bowl Shaped Janus Particles

The seminar will be given in English

תקציר ההרצאה :

Micro-/nano-motors, known also as active particles, have an important role in a broad range of biomedical applications, e.g. drug delivery, lab-on-a-chip immunosensing and environmental applications. These self-propelling particles asymmetrically harvest and consume energy of various sources, including optical, chemical, acoustic, electric or magnetic, to result in a net propelling force. Micromotors have also been shown to enable loading of cargo by various mechanisms. We have recently discovered (Boymelgreen et al., Nat. comm., 2018) a unified approach of transport and cargo manipulation using an electrically-powered Janus particle (JP). However, while most studies examined spherically shaped JPs, here we studied the effective electrical propulsion and cargo trapping and transport capabilities of micro-bowl shaped Janus particles (JPs). These active JPs are made by deposition of Au and Ti layers onto sacrificial spherical polystyrene particles, a process during which the Ti is oxidized (S. Tang et al., Adv. Funct. Mater., 2019). In contrast to the commonly studied spherical JP, the dual broken symmetry of both geometrical and electrical properties of the micro-bowl renders the strong dependence of its mobility and cargo loading on the order of the layering of Au and TiO_2. Specifically, an opposite direction of motion is obtained for interchanged layers of Au and TiO_2, using only electrical propulsion as the sole mechanism of motion. The concave side of the micro-bowl exhibits a negative dielectrophoretic trap of large size wherein trapped cargo is protected from hydrodynamic shearing, leading to a significantly enhanced cargo loading capacity compared to that obtained using common spherical JP. Furthermore, these micromotors are able to release the cargo at time of need. Lastly, the TiO_2 layer seems to be only partially oxidized with a conductive titanium core that is not completely screened and as a result the equator of the outer TiO_2 coating (i.e. on the convex side) acts as a nDEP instead of pDEP trap. This was verified against an electrically insulating relatively thick dielectric layer of SiO_2, that did exhibit a nDEP trap on its equator. The enhanced cargo capability of the microbowl relative to that of a spherical JP as well as the ease of engineering it by interchanging the order of the layers is very attractive for future in-vitro biological and biomedical applications.

בברכה,

פרופ"ח מתי' סאס

מרכז הסמינרים