המחלקה להנדסת חומרים
אוניברסיטת בן-גוריון בנגב
Department of Materials Engineering
Ben-Gurion University of the Negev

# סמינר מחלקתי – הנדסת חומרים

**הנכם מוזמנים בזאת לסמינר מחלקתי**

**אשר יתקיים ביום ה', 1 בדצמבר 2022 , ז' בכסלו תשפ"ג**

**בשעה 11:00, בבניין 51 אולם נגו 15**

## Plasmons or Phonons? An Operando Diffraction Study of Photocatalysis

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Plasmonic materials have gathered significant attention in the past decade, particularly with respect to so-called plasmon-enhanced catalysis. Plasmons present themselves as electric field oscillations that are enhanced around some metallic nanostructures (most notably Cu, Ag, and Au) and can thereby energize electrons. Many have proposed that such "hot" electrons can be exploited to enhance catalytic activity, and yet, despite many high-impact publications on the topic, the simultaneous heating of catalytic particles together with plasmon formation makes it difficult to parse apart the contribution(s) of the light towards enhanced activity. Specifically, a continuous wave of visible light will heat up the catalyst resulting in an alternative explanation for increased activity. To solve this mystery, one must employ an unambiguous and direct method for probing the catalyst temperature during the reaction itself. In this work, we developed an operando photocatalytic diffraction reactor to determine if supported Cu nanoparticles catalyze CO oxidation via thermal activation or plasmonic activation. We suggest that our method can be used universally to disambiguate the contributions, and legitimize findings of plasmonic enhancement, or not.

Short Biography:

Brian Rosen is an Associate Professor the Department of Materials Science and Engineering at Tel Aviv University and the head of the Energy Materials Laboratory. The laboratory specializes in the design of novel ceramic catalyst for fuel cells (PEMFC, AFC, $H_2$/$NH_3$-SOFC), and synthetic fuel production ($H_2$, $NH_3$, syngas) via thermochemical and electrochemical routes. The Rosen lab investigates innovative ways to modulate catalyst activity in ceramics via multi-scale defect engineering, strain engineering, solid-state phase separations, and electronic structure modulation. Prof. Rosen was named one of Israel's 35-under-35 by 'Calcalist' and 40-under-40 by 'The Marker' in 2017, and Young Innovator Award in Nanocatalysis Research by the Springer journal *Nano Research* in 2021. Prof. Rosen received his bachelor's degree in Chemical Engineering from the University of Delaware in 2008 and his PhD from the University of Illinois at Urbana-Champaign in 2013. Prof. Rosen was named as U.S. Department of Energy Office of Science Graduate Fellow in 2010. Prof. Rosen's work was also the basis for a US-based startup company, Dioxide Materials (Boca Raton, FL) which develops industrial $CO_2$ electrolyzers and the Israeli startup Fonto Power which develops AI-Guided SOFC-hybrid systems.