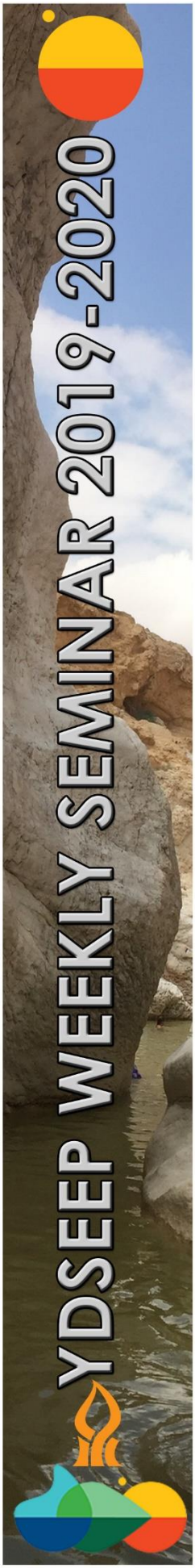

Ben-Gurion University of the Negev
Blaustein Institutes for Desert Research
The Swiss Institute for Dryland Environmental and Energy Research
Alexandre Yersin Department of Solar Energy and Environmental Physics

Nano-Reinforced Composites: Performance and Percolation

Prof. Oren Regev

Department of Chemical Engineering
Ben-Gurion University

Abstract:

The unique properties of nanomaterials and their extremely large interfacial area, have promoted their incorporation in composite materials. A handful of nanocomposites with enhanced properties have been prepared employing a wide range of nanomaterials (used as nanofillers) differing in their morphology, composition and quality. However, a set of design rules for optimal enhancements is still missing. Does the *dimensionality* of the nanofiller affect its optimized performance? What is the effect of the matrix material?

I studied these fundamental questions in two antagonist matrices, namely, *granular cement* and *continuous polymer*, reinforced by a few types of nanofillers differing in their dimensionality. For both systems, I identified an optimal nanofiller concentration in which the maximal performances are obtained. I suggest that this behavior relates to nanofiller concentration thresholds (mechanical, electrical or rheological), analyzed by the percolation theory. For both polymer and cement systems, I found that indeed the performance of the composite is optimal near these threshold concentrations. Consequently, I introduce few design rules: *robustness, reinforcement efficiency and a figure of merit* that takes into account key composites parameters. These values provide rules for designing nanocomposites, and they are applicable for both granular and continuous systems.

Date & Location:

Tuesday, December 10, 2019, 11:00
Lecture room, Physics Building (ground floor)