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|  |  |  הטכניון - מכון טכנולוגי לישראל TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY  |
| הפקולטה להנדסה כימיתע"ש וולפסון |  |  |
| The Wolfson Department of Chemical Engineering |  |  |

**Wolfson Department of Chemical Engineering Seminar**

**Monday, April 8th, 2024, at 14:00**

**Room 1**

**Responsive Colloidal Self-Assembly as a Nanotechnology Paradigm for Analog Control of Fluid Transport**

**Gideon Onuh**

**Mid-PhD Seminar**

Advisor: Prof. Ofer Manor

Department of Chemical Engineering, Technion-Israel Institute for Technology

The underlying non-covalent interactions that drive the self-assembly of colloidal particles have been of essential interest in the field of colloid science. In our first project, we investigated the contribution of surface forces, such as electrostatic, van der Waals, solvation, bridging, and depletion interactions, to the self-assembly of particulate structures. Calcium alginate and polystyrene microparticles were assembled on glass under varying ionic strengths, exhibiting adjustable energy barriers governing adsorption. At high electrolyte concentrations, a continuous calcium-alginate network is formed with embedded polystyrene pockets.

In our second project, we investigated depletion interactions between 1µm polystyrene particles on glass substrates. Nanoparticles at 0.5\% (wt/v) supported well-ordered close packing, while polymers induced irregular aggregates. Mixing nanoparticles and polymers enhanced aggregate size and coverage. Tuning pH level further modified polymer conformations thereby directing the deposit morphology.

In our current project, we look at silica particles that are densely grafted with pH-sensitive polymers to demonstrate reversible aggregation/dispersion dynamics, which is dependent on solution pH. Within a packed column, these "colloidal gates" control liquid and molecule transport, with increased permeability at higher pH where particles are dispersed. By correlating surface forces to observed assembly structures and mass transport performances, we demonstrate stimuli-responsive colloid engineering using particulate networks for tailored material properties and flow regulation.