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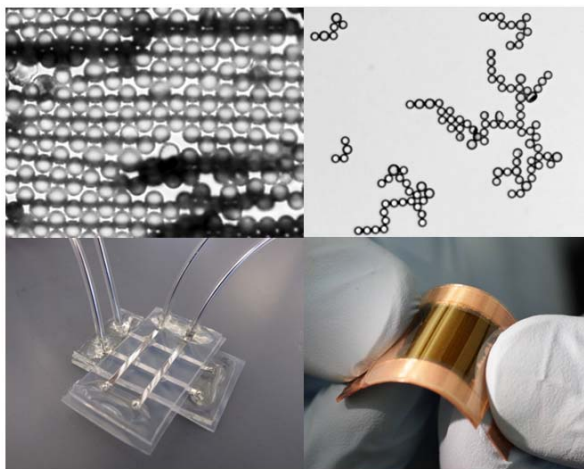
DR. ORLIN D. VELEV

INVISTA Professor

*Department of Chemical and Biomolecular Engineering
North Carolina State University*

“Electrically Functional Soft Matter: From Precise Colloidal Assembly to Hydrogel Photovoltaics”

We will present strategies for the fabrication of novel electrically functional structures from particles or gels operating in water environment. In the first part of the talk we will discuss how electric fields can be used to assemble metallic or dielectric particles and live cells into electrical connectors, networks and sensor prototypes. The structures formed include microwires from metallic nanoparticles, crystals with conductive lanes, and biocomposite membranes from live cells. We will demonstrate how Janus and patchy metallodielectric spheres can be assembled in new types of colloidal crystals and gels and how the type of structures formed can be precisely controlled by the induced frequency-dependent dipolar and quadrupolar interactions. In the second part of the talk we will discuss how water-based gels doped with polyelectrolytes can be used as the core of novel diodes, memristors and photovoltaic cells operating on the conductance of the counterionic layers around the gel molecular backbone. A new class of “soft” diodes with rectifying junction formed by interfacing water-based gels doped with polyelectrolytes of opposite charge was developed. These structures were recently used as a basis of a new class of memristors, composed entirely of soft and liquid matter by interfacing the gel stacks with liquid metal electrodes. We also demonstrated a radically new concept of bio-inspired hydrogel solar cells. The matrix of these photovoltaic cells is made of ionic agarose gels doped with



photosensitive organic molecules. They have open circuit voltages and current density comparable to polymer photovoltaics. Such gel-based “artificial leaves” can be flexible, inexpensive and environmentally friendly.