

# Increasing Energy Efficiency



Nicholas A. Kotov

Joseph B. and Florence V. Cejka Professor of Engineering

## CURRENT RESEARCH

### Bioinspired materials

Living cells are capable of the most efficient energy utilization. Unlike any manufacturing process known today, cells are nearly 100% efficient because their machinery assembles itself. Dr. Nicholas Kotov, Joseph B. and Florence V. Cejka Professor of Engineering at the University of Michigan, is working on replication of such processes for cornerstone materials of today's electronics – semiconductors and metals. The knowledge and device prototypes that Dr. Kotov obtains in his studies enable tremendous leaps in technological efficiency.

Dr. Kotov already demonstrated that self-organization leads to biomimetic materials some thought to be impossible to make. Moreover, he also developed and patented technology to make them at scale. Dr. Kotov has pioneered bionic supraparticles that self-assemble from proteins and semiconductor particles. These assemblies seamlessly integrate and enhance the properties of both. One of the milestones for his future work is the implementation of nanoparticle self-assembly for battery components. Inexpensive biosensors to test water contamination and food quality are among his immediate technological targets as well. Dr. Kotov and his team collaborate with colleagues around the world to make practical realization of his discoveries.

Current research includes:

- Engineering of Force-Fields: Self-assembly processes at nanoscale require knowledge of forces acting at the nanoscale. They are multiple and each of them is complex. Methods for their quantitative control are still mysterious and represent the next frontier in nanoscience. Knowledge of the nanoscale forces is required for the design of complex self-assembled structures...

## AFFILIATION



University of Michigan

## EDUCATION

- Ph.D., in Physical Chemistry, 1991, Moscow State University

## AWARDS

- MRS Medal (MRS), 2014
- Langmuir Lecturer Award (ACS), 2013
- Stine Award for Materials Research (AIChE), 2012
- Top 100 Materials Scientists in 2000-2010 (Thomson Reuter), 2011
- Gran Prix, Materials Research Society Entrepreneurship Challenge (MRS), 2006

## RESEARCH AREAS

Technology, Chemistry, Materials Science / Physics, Nanotechnology

## FUNDING REQUEST

Your contributions will support the continued research of Dr. Nicholas Kotov, of the University of Michigan, as he engineers materials to solve technological bottlenecks. Donations will fund the necessary \$1.5M/year required for personnel, the use of electron microscopy, and new equipment for prototyping. In choosing to donate, you will play a vital role in developing biologically inspired technologies.

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