Materials, Chemistry and Processes for Opto-Electronics, Bio-Electronics and Energy Devices

Facchetti Lab @ GT

Our work focuses on designing stretchable polymer, semiconductor and hybrid nanostructures for applications in high performance, ultra flexible optoelectronics, bioelectronics and energy applications. We explore the structure-property-performance relationships in inorganic, organic and hybrid materials using novel synthesis and device processing techniques.

For a full list of research areas and publications, visit us on our website:

Email: afacchetti@gatech.edu

Organic/Printed/Soft Electronics

Goal: Advancing organic/printed/soft electronics, a novel approach to fabricating electronic devices on flexible plastics using soft organic/hybrid materials and printing methods. We aim to develop thin-film transistor (TFT) materials for flexible displays, electronic tags, and sensors with improved flexibility, impact resistance, and cost-effectiveness.

Transparent/Solution Processable Metal Oxide Electronics

Goal: Advancing transparent electronics to create functional materials/devices for consumer electronics, energy harvesting, and transportation. Innovations transforming glass surfaces into electronic devices enhance security systems and enable electricity generation. Our progress in materials, processing, device architectures, and circuit integration are driving this field.

N-Doping of Organic Semiconductors

Goal: To address variations in chemical accessibility, doping efficiency, electron mobility, and conductivity for n-doped materials. Our recent discovery that Au nanoparticles can catalytically enhance the doping of organic semiconductors with a molecular dopant (N-doping), enhances n-doping efficiency and electrical conductivity in organic semiconductors.

Energy Production and Storage Materials

Goal: Sustainable, affordable energy production and storage, focusing on thin-film photovoltaic (PV) cells, including organic and perovskite types, optimizing photovoltaic/charge-carrying materials and battery tech for consumer electronics, electric vehicles, sensors, smart clothing, and e-skin. Emphasis is on targeting challenges such as reliance on critical raw materials and poor battery performance on deformable platforms.

Organic SERS Sensors

Goal: Surface-enhanced Raman spectroscopy (SERS) is a powerful surface-sensitive technique. While nanomaterials are performing with enhancement factors > 10^9, they are limited by high cost, complex fabrication, and chemical aging. Our research has identified certain organic semiconductors as efficient SERS-active platforms for molecular detection.

Major Collaborators:

- Prof. J. M. Mogileva
- Prof. T. J. Marks
- Prof. M. Katakis
- Prof. M. R. Wasielowski
- Prof. M. Horvath
- Prof. G. Schatz

- Prof. S. Fabiano
- Prof. H. Hata
- Prof. G. Damil
- Prof. M. van der Boom
- Prof. M. Chiu
- Prof. A. Marrocchi
- Dr. D. DeLongchamp

- Prof. J. P. Correa-Baena
- Prof. R. Ponce Ortiz
- Prof. M. Shin
- Prof. S. S. Jiang
- Prof. J. Kacher
- Prof. M. G. Kim

- Argonne National Laboratory
- Sandia National Laboratories
- Battelle
- NSRRC