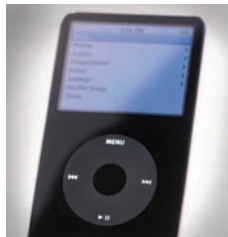


FACULTY PROFILE

Hess Investigates Graphene's 'Unimagined Applications'

By Kimberly Link-Wills



The National Science Foundation awarded \$8.1 million to Georgia Tech this fall to create the Materials Research Science and Engineering Center, focused on the development of graphene and its potential to replace silicon.

Dennis Hess, the Thomas C. DeLoach Jr. chair of the School of Chemical and Biomolecular Engineering, was named director of the center, housed in the new Marcus Nanotechnology Research Building.

The lab's research is a crossdisciplinary effort utilizing the talents and resources of Tech as well as those of the University of California, Berkeley; University of California, Riverside; Alabama A&M; and the University of Michigan. Initially, the lab will house research conducted by 13 Tech faculty members and five from the partner institutions.

Interim President Gary Schuster says Tech's graphene research will bring Atlanta a nickname to rival Silicon Valley.

"There is the potential that graphene is going to replace all the silicon that's in your cell phone and computer," Schuster says. "I'm going to predict that in a few years Atlanta is going to be known as Graphene Junction. That's where the next generation of technology that is going to be powering up the revolution in electronics is going to occur, and it's going to occur right here on the Georgia Tech campus."

Hess, who earned his bachelor's degree at Albright College in 1968 and his master's and doctorate at Lehigh University in 1970 and '73 joined the Tech faculty in 1996.

Why did you choose a career in academia?

I had been interested in a position in academia since enrolling in graduate school but decided that I should gain some industrial experience first. After four years at Fairchild Semiconductor, I accepted a position as an

assistant professor in chemical engineering at the University of California, Berkeley, which wanted to initiate a program in microelectronics processing since many of their graduates were joining microelectronics firms in Silicon Valley. This was the first formal program in microelectronics processing in a chemical engineering department.

Close interactions with students in courses and research along with the freedom to undertake research directions of my choosing — provided that I can raise the necessary funds — are the reasons that I have remained in academia. I stayed at Berkeley for 14 years until the lure of moving back to the East and closer to family took over.

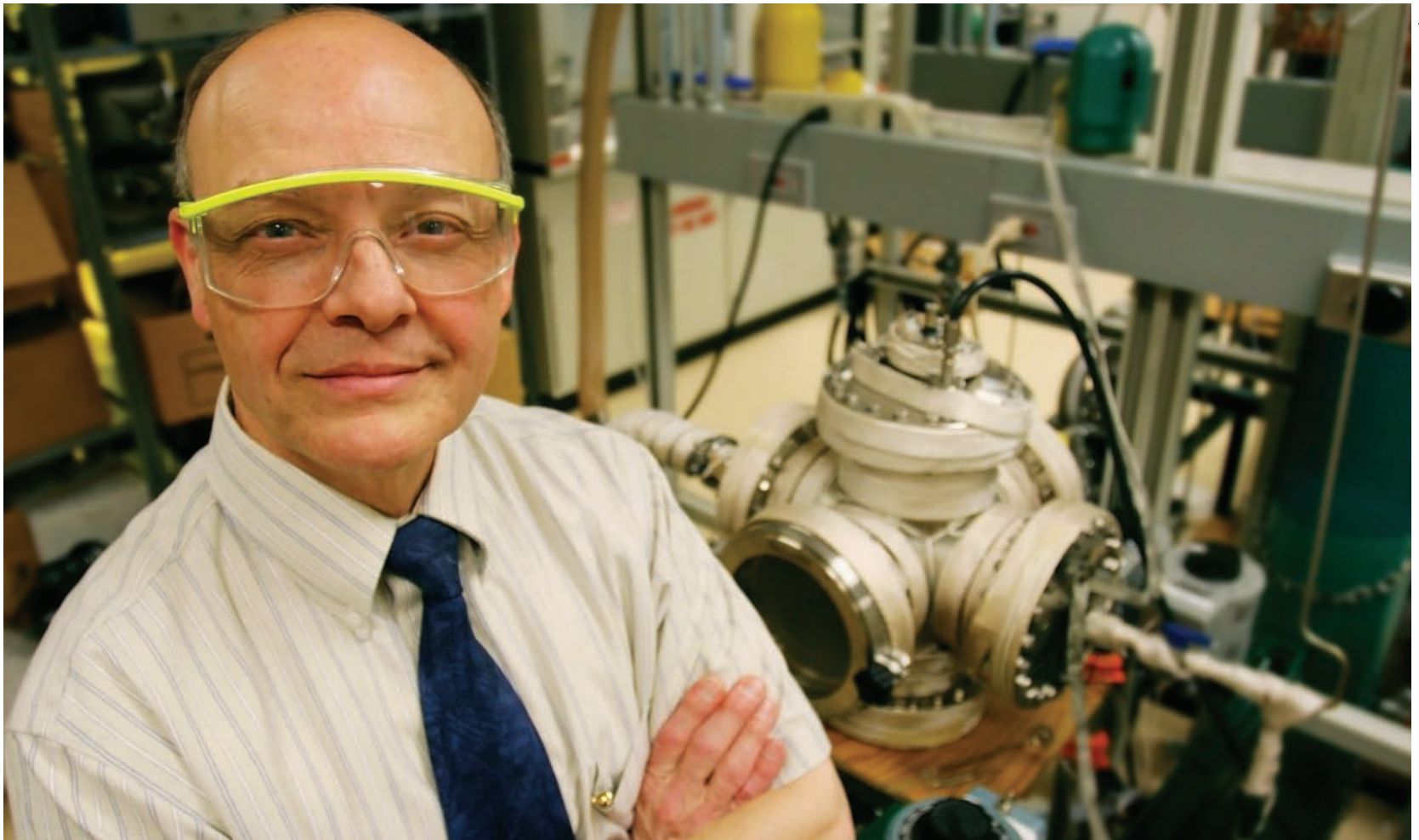
What brought you to Georgia Tech?

As I was completing my five years as the chemical engineering department chair at Lehigh University in 1996, I was ready for a change. The year before, the chemical engineering department at Georgia Tech had invited me to give a seminar on my research, and I was very impressed with how the school was progressing.

They had hired several excellent senior faculty members I had known for some time — Ron Rousseau, Chuck Eckert and Paul Kohl — and also had hired a number of outstanding young faculty members. This indicated that the chemical engineering department was poised for continued and enhanced success and thus represented a great opportunity. I wanted to be part of this effort since this was clearly a school that was on the move.

Briefly explain graphene research.

Continued advances in microelectronic devices and integrated circuits and the fundamental limitations of silicon properties have led to the need to find a successor to silicon



Eric Turner

for future devices. Graphene, which is a single or generally a few layers of graphite, offers the potential for higher-speed devices than silicon with similar structures that can be fabricated with some of the same processing approaches to those currently used. However, extensive materials characterization of graphene properties, their connection to processing techniques and methods to successfully form layers of graphene for device fabrication are required.

How will mankind benefit in the future from graphene research being conducted at Tech today?

The phenomenal advances in microelectronic devices have made possible laptops, cell phones, iPods, supercomputers and astounding movie effects. Higher-speed materials and devices can improve the performance of such devices and will offer the potential for new and, to date, unimagined applications for integrated circuits due to the enhanced computational and processing speed expected from graphene devices. Realization of such expectations is probably at least 10 to 15 years away.

Although our center will focus initially on the fundamental understanding of graphene

and other electronic materials as possible successors to silicon-based electronics and will facilitate technology transfer to industry, there may be other more immediate uses for graphene. Biocompatible biosensors are one possibility. Similar to carbon nanotubes, the high conductivity of graphene will likely find application as a material additive for application-specific polymers or nanocomposites since the cost to manufacture graphene flakes appears to be much lower than that of CNTs. Graphene layers also may find use as electrodes for batteries and as optically transparent electrodes for photonic devices.

If, as expected, lowered cost and enhanced performance result from the use of graphene in such applications, society will benefit immensely.

Please complete this sentence.

I don't leave home without:

A book or articles — technical and nontechnical — to read.

What are you reading now?

I recently finished *Einstein* by Walter Isaacson and am now reading *Mark Twain* by Ron Powers.

Dennis Hess has been named director of Tech's new Materials Research Science and Engineering Center, focused on the development of graphene and its potential to replace silicon. "If, as expected, lowered cost and enhanced performance result from the use of graphene ... society will benefit immensely."