

# IEEE RRVS October 2005 Dinner Meeting

27 October, 2005

Featuring Daniel Gamota, a Senior Manager at Motorola, who earned a PhD in Material Science and Engineering, and is a managerial leader in multi-company ventures including; Dow Chemical, Xerox Canada, PARC, and Motorola.

## Review by Ron Hendrickson

Our dinner meeting tonight, the 27<sup>th</sup> of October, was at the Woodward Technology Center. At this event 21 people enjoyed the dinner buffet of boneless baked chicken breast, vegetarian lasagna, baked potatoes, mixed vegetables, and mini cream puffs for dessert (same as last months, I put out a motion that maybe we should have some sort of change!). Out of the 21 attendees, 5 students from NIU made the trip from Dekalb, to enjoy/learn from the presentation delivered by Daniel Gamota, while 2 students came from Rock Valley. For the presentation; about 15 people from Professor Joe Etimans and Professor Steve Fleeman class were treated with the opportunity to hear Dr. Gamota's presentation. For the potential growth of our section we need to recruit these students. Announcements were made that the next RRVS meeting will be at NIU the 15<sup>th</sup> of November. There will not be a meeting in December and RRVS will be planning a gathering the last Thursday in Jan. 06.



Daniel Camota

**Presentation Begins:** What he "really does" is particulate the engineering into a product that is used in every given day". Motorola is trying to commercialize a specific product. Dan and his team have been working on printable electronics for 5 years (there are currently about 20 competitors). In the past year and a half there have been many printers put on the market, but none with the resolution needed (need to spend \$5,000) Right now printable graphics are "static", so the printers resolution does not matter. The vision five years ago was to have interactive communication with circuits printed on paper. Boxes can now glow in the dark, packages will talk to you, and the opportunity to print out a big screen TV is also possible (you will also have a RF link). Printing will be all over the place because it will be interactive. This technology is not new. What's new

is all of the applications for a printed electronic sheet.

Dan went on tell us that the electronic capacity (horsepower) of the Furby toy (popular Christmas gift a couple years ago) was equal to the ISP and semi-conductors used to send a spacecraft to the Moon in 1969. Billions and billions of dollars have been invested into the semi-conductor industry **because** everyone wants higher performance. We all have computers, MP3s, and cell phones (most people). Dan illustrated how performance increases as silicon feature size gets smaller. This and the basic properties of silicon have not changed in 30 years. Moore's Law indicates that electronic device density, and performance, doubles approximately every 18 months, driven mainly by reduction in silicon feature size. Solar panels and batteries, similar to what was done with Polaroid cameras a number of years ago, are being printed on paper. . General Electric now has a printed lighting system (think of a light bulb). It will even print antennas, copper wiring, using a carbon based ink or a super based ink to reduce the cost. Some companies (I know of Wal-Mart) are going to use this technology in their plans to move to RFID.

Standards need to be established because there is much information coming from all over the globe (example; Singapore, Germany, and the United States). Ideas are being developed for engineers and scientist to use. There is even a thought of having a printer at some colleges that would eliminate the need for a clean room. It will print features (or dimension) to a 6-10 micron tolerance. Your eyes can interpret 40 microns. Printers are the tool that's needed for the move from micro to nano.

The ultimate goal is to have an all printed product. You will need a display, power source, and the circuit. The ink is infused with nanoparticles of semi-conductive material. New ink is being developed almost every day. They use organic ink, but NIST is excited because the higher the mobility number the higher the performance/speed (this lets you do wireless communication). Dan's team is looking for higher performing ink. This will allow RFID (Gigahertz does not pass through liquids but provides long distance communication capability) to take place. Through nanotechnology the NIST (National Institute of Standards and Technology) is working on tools that will help look at the interface of the transistor (drain, source, and dielectric). Integrated circuits (ICs) are made up of transistors. Nanotechnology plays a key role in being able to print transistors on paper.

As Mr. Gamota opened the floor for questions, I had an investment question. Since Motorola was big in 2-way communication back in the late 80's (think Nextel now), Satellite & STU-III (secure telephone Unit) Communication (from a retired military officer), pagers in the early 90's, the birth of Six Sigma (the Forum now publishes a quarterly magazine 2001), Cell phones (late 1990's, and now the razor phone (2005), what's next? After a chuckle Dan said that Samsung has already duplicated the Razor phone, and a new phone will come out in November.

From an environmental perspective the ink used in printing circuits on paper is green and commercially available today. Varnish can be used as the dielectric. Semi-conductor ink is not toxic. This is why the EU is very interested in printed electronics. 95% of products shipped have some sort of toxic lead/solder in them.

RRVS would like to **thank Dr. Gamota** for his presentation and for the thousands of sheets of integrated circuits that have been printed, and especially for the use of nanotechnology in RFID and printing ICs on paper. As Dan indicated during questions, "This could be the next big thing". This one page summary only covers a small portion of his presentation, but these issues have been documented for further discussion.