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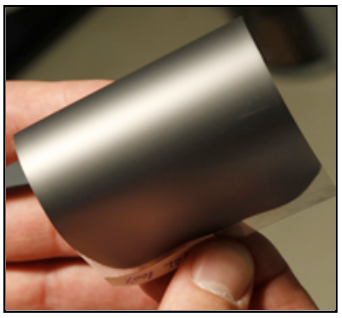
Vorbeck Materials Makes Inroads in Graphene Technology

By David Savastano

While there have been significant gains made in the field of printed electronics (PE), there are technical hurdles that must be overcome in order to take PE to the next level. One area is developing inks that offer high conductivity at a better price than silver inks.



As one of the strongest and most thermally conductive materials known, graphene appears to be one promising opportunity for the PE market.

Vorbeck Materials, a Jessup, MD-based company, is making inroads in graphene technology with its Vor-ink conductive inks and Vor-x graphene formulations and composites.

“Graphene-based inks certainly can be used in a number of applications where traditional carbon-based inks can not attain sufficient conductivity, and Vor-ink’s price point is at a significant discount from silver inks,” said John Crain, Vorbeck’s vice president of strategy and business development.

Vorbeck Materials came into being three years ago, utilizing technology originally licensed from Princeton University, where three of Vorbeck’s founders were professors.
“We set up Vorbeck Materials to build upon the work of our co-founders and inventors, Aksay, Prud’homme and Saville,” said Crain. “Our mission has been, through internal development as well as through commercial partnerships, to develop commercial applications for graphene.”

The company is enjoying success, attracting interest in cooperative ventures as well as attracting investments. In conjunction with BASF, Vorbeck established a joint research program to develop graphene-based formulations and composite materials. As part of the collaboration, Vorbeck and BASF are developing dispersions of highly conductive graphene for producing electrically conductive coatings and compounds, especially for the electronics industry.

Vorbeck also has secured $5.1 million in a Series 2 financing led by Stoneham Partners, a private investment firm, with contributions from the Maryland Department for Business and Economic Development and a syndicate of individual investors. The company will use the capital to expand development of its Vor-x graphene and Vor-ink conductive inks for printed electronics applications.

The Benefits of Graphene

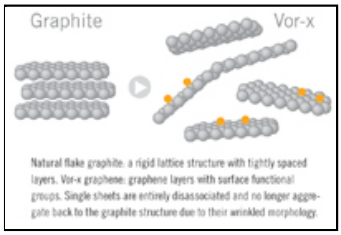
Graphene formulations offer key benefits, most notably improved conductivity; even in thin coatings of 1
micron, Vor-ink maintains its rated conductivity. In addition, Vorbeck has developed a scalable process and commissioned a pilot plant capable of manufacturing graphene in ton quantities.

“Conductivity is the key reason to use graphene in electrical applications,” Crain said. “Graphene is non-metallic, so it does not require sintering, allowing our Vor-ink to be cured at low temperature. I can see a trend toward lower and lower curing temperatures, driven by the need to use new substrates that are more susceptible to heat.

“Graphene’s key benefits also include providing mechanical enhancements, improved electrical and thermal conductivity, providing a very effective barrier against gas permeation as well as solvent penetration, such as automotive fuel,” Crain added. “Graphene can also drastically lower a polymer’s coefficient of thermal expansion.”

Vor-ink is also an environmentally friendly product, as Vorbeck utilizes eco-solvents in its manufacture.

Crain noted that there are plenty of markets where graphene can play a role, and trials are underway.



“We have begun to trial our conductive inks in a number of companies,” Crain noted. “Key markets that are looking at our Vor-ink are backplanes for displays, thin film photovoltaics, interconnects, smart packaging applications, and RFID antennas.”
Vor-ink comes in a variety of grades. Aside from its Vor-ink and Vor-x products, Crain noted that the company also customizes formulations. Currently, Vorbeck has gravure and screen ink products that it is trialing.

“We are still in trial and not yet commercial, and the trials are going quite well,” he said.

Vor-ink gravure provides good coverage at low film thicknesses and high printing speeds for a variety of substrates, including coated papers and label stock. Vor-ink screen is specifically formulated for screen printing applications, where viscosity and solids content ensure optimal coverage and exceptional conductivity on paper, paperboard and PET films. Crain added that Vorbeck is working on flexo and inkjet versions of its graphene inks.

“We know we have a compelling product for applications which demand high performance at a competitive price,” Crain concluded.