NEWS RELEASE

SHOWA DENKO K.K.
13-9, Shiba Daimon 1-chome
Minato-ku, Tokyo 105-8518

June 3, 2013

SDK Develops Microwave-based New Materials for Printed Electronics
--Offering Conductive Ink, Curing Unit, and Conductive Adhesive for Manufacture of Electronic Circuits on FPCs--

Showa Denko K.K. (SDK) has developed an innovative microwave-heating printing technology to form electronic circuits on flexible printed circuit substrates (FPCs), in which plastic films and other materials with low heat resistance are used.

As part of the new technology, SDK has developed a printable silver/carbon hybrid conductive ink and an ink-curing unit. SDK has also developed a printable conductive adhesive usable in microwave-heating, thereby significantly reducing migration [1] that causes deterioration in product quality. As a result, it has become easy to form electronic circuits on FPCs and mount devices by printing.

SDK will, through its subsidiary Shoko Co., Ltd., start selling the ink-curing unit, as well as offering samples of the silver/carbon hybrid conductive ink and the conductive adhesive. These products will be exhibited at “JPCA Show 2013” to be held at Tokyo Big Sight from June 5 through 7.

1. Silver/carbon hybrid conductive ink and ink-curing unit
   In printed electronics, conductive inks printed on substrates are heated and cured to form electronic circuits. When low-heat-resistant substrates and parts are to be used, it becomes necessary to heat required portions only, using selective heating technologies. [2]

   Microwave heating is one of the selective heating technologies, as is Photonic Curing™ process technology already introduced by SDK. Microwave heating is suited for printing on low-heat-resistant plastic films and for roll-to-roll continuous printing. Furthermore, microwave can penetrate into a substrate, enabling the formation of conductors inside a substrate and the bonding of internal parts.

   In the conventional microwave heating, there is a problem of spark discharge involving conductive inks that contain metallic materials. SDK has developed a new technology, jointly with Professor Yuji Wada, of Tokyo Institute of Technology, and The National Institute of Advanced Industrial Science and Technology (AIST), to control spark discharge by separating microwave’s magnetic field and electric field and applying the fields separately in heating [3].

   In our newly developed silver/carbon hybrid conductive ink optimized for this technology, carbon particles (which do not develop a phase change during heating [4]) have been added to silver particles. This step ensures uniform curing of the ink under microwave heating, preventing a non-uniform distribution of conductivity. Conventional silver inks tend to develop, upon absorption of microwave, a non-uniform phase change due to melting, resulting in non-uniform distribution of conductivity.

This development forms part of the New Energy and Industrial Technology Development Organization's (NEDO) research project on "Development of Both Metal Thin Film Fabrication Technology with Microwave and Its Patterning Technology," coming under "Research and Development for Nanotech and Advanced Materials Applications."

2. Halogen-free conductive adhesive

   In the wiring of electronic circuits, silver-containing conductive adhesives are generally used to ensure conductivity. However, silver tends to cause migration due mainly to halogen components contained in peripheral materials. SDK has developed, jointly with Professor Katsuaki Suganuma, of Osaka University, a halogen-free conductive adhesive, enabling substantial reductions in migration.

   This adhesive can also be used with the newly developed microwave-heating equipment. The adhesive can be printed on a plastic film, and subjected to heating and curing with devices being mounted on the substrate.

   The adhesive is based on the epoxy resin manufacturing technology [5] developed jointly by SDK and AIST as part of research projects in the areas of "Development of Fundamental Technologies for Green and Sustainable Chemical Processes; Development of Innovative Chemical Process-Product with Less Waste Emission; and Fundamental Technology Development of Innovative Oxidation Process." These projects were sponsored by the Ministry of Economy, Trade and Industry in 2008, and by NEDO in two stages, namely, in the 2009-2011 period and in 2012. Resin formulations have been optimized for conductive adhesive applications.

   Printed electronics—the technology to manufacture electronic circuits through printing—is expected to be increasingly used as an efficient production method for electronics, electric appliances, and transport machinery. SDK will continue to work to develop and commercialize materials for printed electronics through collaboration with outside partners.

Notes:

1. Migration: Movement of metals on the surface of or inside a nonmetallic medium, resulting in short circuit.
2. Selective heating: Technology to heat selected portions only. In the Photonic Curing™ process technology and microwave heating, only metallic substances, such as silver, absorb the energy and generate heat.
3. This microwave heating equipment is designed and produced by Fuji Electronic Industrial Co., Ltd.
4. Phase change: A phenomenon in which the arrangement of molecules/atoms changes substantially after heating or cooling of substances.
5. A new process for producing alicyclic epoxy compounds, using hydrogen peroxide as oxidizing agent. Chlorine is not used in the production. (Announced by SDK on September 18, 2012.)

For more information, contact:
Public Relations Office (Phone: 81-3-5470-3235)