Printed Electronics

Product Flash

No. 1.01
June 2009

RAHN | EnergyCuring

Energy Curable Technologies and Printed Electronics

Printed electronics is the broad term for a relatively new technology that defines the printing of electronics on common substrates such as paper, plastic, and textile using standard printing processes. The technology is believed to be one of the fastest growing in the world with an estimated USD 300 billion dollar market potential.

Common press equipment used in the graphics arts industry, such as screen printing, flexography, gravure, ink-jet and offset lithography are employed. Instead of printing graphic arts inks, families of electrically functional electronic inks are used to print devices, such as thin film transistors. Printed electronics is forecast to facilitate the development of very low-cost electronics useful for applications not typically associated with conventional (i.e., silicon-based) electronics, for example;

- Healthcare & Medical devises
- Transit
- Thin/Flexible Batteries
- Conformal/Fexible Displays
- E-readers
- Photovoltaics
- Transistors & Logic
- Roll-to-Roll Manufacture Challenges/Opportunities
- Stretchable Electronics for Clothing
- Conductive Materials
- Organic & Inorganic Semiconductors
- Graphene Carbon Nanotubes
- Sensors & Actuators
- Lighting
- RFID
- Smart Substrates & Stretchable Electronics

Energy Curing is the broad term used to describe the technology used to "cure" or rapidly dry specially formulated inks, coatings and adhesives. The technology is widely deployed in conventional graphic arts printing bringing the following motivations versus other technologies like solvent based and water based solutions.

1. Increase Productivity
2. Improved Physical Properties/Product Performance
3. Enabling Technology/New Capabilities for User
4. Cost Effective/Lower Price
5. Environmental Compliance/Green Technology-100 % solids
6. Suitability for heat sensitive substrates

Energy Curing is normally broken down to two curing techniques.

- UV curing, this means formulations that are cured by exposure to light in the 200-400nm sector of the electromagnetic spectrum
- EB curing, this means formulations that are cured by exposure to high energy electrons

Components of energy curable formulations are

Oligomers: The overall properties of any coating, ink, adhesive or binder crosslinked by radiant energy are determined primarily by the oligomers used in the formulation. Oligomers are moderately low molecular weight polymers, most of which are based on the acrylation of different structures.The acrylation imparts the unsaturation or the "C=C" group to the ends of the oligomer.

Monomers: Monomers are primarily used as diluents to lower the viscosity of the uncured material to facilitate application. They can be monofunctional, containing only one reactive group or unsaturation site, or multifunctional. This unsaturation allows them to react and become incorporated

RAHN AG
Dörflistrasse 120 | CH-8050 Zürich | T +41 44 315 42 00 | F +41 44 315 42 65
www.rahn-group.com | rahn@rahn-group.com

into the cured or finished material, rather than volatilizing into the atmosphere as is common with conventional coatings. Multifunctional monomers, because they contain two or more reactive sites, form links between oligomer molecules and other monomers in the formulation.

Photoinitiators: This ingredient absorbs light and is responsible for the production of free radicals. Free radicals are high energy species that induce crosslinking between the unsaturation sites of monomers, oligomers and polymers. Photoinitiators are not needed for electron beam cured systems because the electrons are able to initiate crosslinking.

Additives: The most common are stabilizers, which prevent gelation in storage and premature curing due to low levels of light exposure. Color pigments, dyes, defoamers, adhesion promoters, flatting agents, wetting agents and slip aids are examples of other additives.

There will be many emerging applications in Printed Electronics that might benefit from utilizing Energy Curing as the technology to cure or dry the printed functional pattern. Energy Curing could also be employed to protect such printed patterns or for other parts of the fabrication process.

Some possible benefits that can be imparted to Energy Curing formulations for PE applications by RAHN energy curable raw materials might be

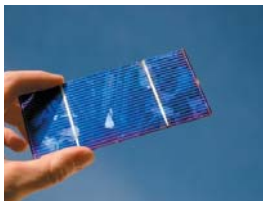
- Adhesion to Difficult Substrates
- Low Shrinkage
- Anti-reflective
- Heat Restistance
- Moisture and Oxygen Barriers
- High Flexibility
- Hydrophobic Properties
- Thin and Thick Film Curing

RAHN and Energy Curing

RAHN's product range covers the entire spectrum of raw materials needed by Energy Curing formulators

- GENOMER* Oligomers
- GENORAD* Additives
- GENOCURE* Photoinitiators
- GENOPOL* Polymeric Photoinitiators
- MIRAMER Diluents and Oligomers

Selection of appropriate materials needs careful consideration of the intended application and process variables. RAHN's sales team is dedicated to offer high quality technical support to customers who have decided to employ Energy Curing technology for a particular application. Even if you are simply trying to establish the feasibility of using Energy Curing for printed electronics we would be interested to talk to you.



RAHN AG
Dörflistrasse 120
CH-8050 Zurich
Tel: +41 44 315 42 00
Fax: +41 44 315 42 65

RAHN GmbH
Hahnstrasse 70
D-60528 Frankfurt am Main
Tel: 0800 1 816 015
Fax: 0800 1 816 016

RAHN USA Corp.
1005 North Commons Drive
Aurora IL 60504, USA
Tel: +1 630 851 42 20
Fax: +1 630 851 48 63

EnergyCuring@rahn-group.com
www.rahn-group.com

06/2009