

## Printed Electronics: Embedded Sensors and more

An overview of the market, technologies, and capabilities








### BACKGROUND

Traditional manufacturing techniques of electronics, such as screen printing, offset lithography and gravure mainly deposit a thin layer of conductive ink onto a flat 2D surface. Due to high unit cost components and complex design limitations of such commercial electronics manufacturing technologies, production of electronics has begun to switch to “Printed Electronics” by utilizing different Additive Manufacturing (AM) technologies such as Inkjet Printing, Aerosol Jet, Extrusion and Laminated Object Manufacturing (LOM).

### SCOPE

From automation to personal health equipment, and smart tools to Internet of Things (IoT), Printed Electronics can be found in various industrial applications. Since the rapid growth of AM, year by year, Printed Electronics technologies keep progressing into a well-established market as well. Thus, in 2019, AMEXCI conducted a project on Printed Electronics with the participation of several shareholder companies in order to screen the growth of this market.

### INSIGHTS

	Inkjet Printing	Aerosol Jet	Extrusion	Laminated Object Manufacturing
Process introduction	Droplet deposition on a substrate through a nozzle	The ink in the atomizer creates a dense mist, deposits droplets between 1 to 5-micron diameter	A paste-like (conductive polymer or silver nanoparticles) material extruded through a nozzle	Sheets of metal are bonded together via Ultrasonic welding technology
Resolution	High	High	Low	Medium/High
Production volumes	Low to medium	Medium	Low	Medium/Low
Ideal applications	Development purposes, end use components, sensors, antennas	End components, sensors, antennas	Development purposes, proof of concepts	Development, proof of concepts, end parts, embedded sensors and cables
Materials	Conductive nanoparticle inks or paste	Metal inks, carbon nanotubes inks, dielectric and semiconductors	Silver inks, conductive thermopolymers	Cables, wires, sensors
Substrate options	Hard/rigid or flexible	Metal, polymer, ceramic, etc.	Thermoplastic polymers or others	Sheets of metal
Main companies	 	  		

An overview of different Printed Electronics technologies, their capabilities, materials as well as the main companies have been summarized in the table. Even though the R&D activities in Printed Electronics have ramped up recently, there is still a need for further industrial adjustments.

The implication of specific design guidelines to integrate circuits as well as the developments in the

standardization of materials and technologies in accordance with the applications could help the end-users of this technology to realize the real potential behind Printed Electronics thoroughly.

With the help of this study, AMEXCI aimed at shedding a light on the ever-growing market of Printed Electronics while broadening our knowledge to get hold of new achievements within this field for eventual electronics applications such as embedded sensors.

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The full version is available for participants of this project within AMEXCI’s shareholder companies.