DP Patterning

Background

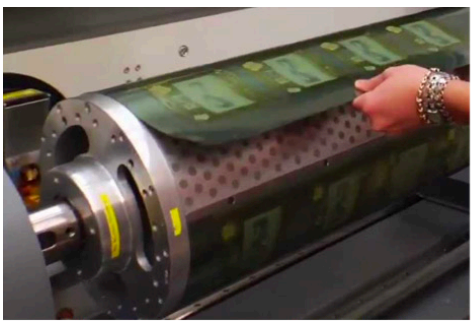
DP Patterning was founded in 2009 to commercialize technology developed by the Swedish research institute RISE. In 2014, its first radio frequency identification (RFID) machine was installed to produce antennas, and in 2018 the first machine to produce circuits for the automotive sector was installed. Since inception, the company has grown organically to its current size of around 15 employees.

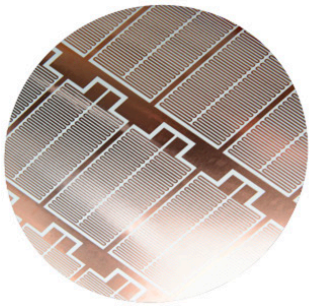
Technology

DP Patterning's core technology is an innovative method of patterning the metal layer on flexible printed circuit boards (FPCB). Example of metals on flex foil laminates used in Dry Phase Pattering process, are Aluminum, CCA (Copper Clad Aluminum) and Copper Rather than the incumbent method photomasking and chemical etching, an entirely dry, mechanical process is used. Process steps are as follows:

- The desired pattern is produced on the cliché by the standard process of laser engraving or photolithography.
- The flexible substrate passes continuously over the cliché roller and is raised in the patterned areas.
- A cutting head with very precise depth control (less than 1 micrometer resolution) cuts away the metal foil in the raised areas, leaving the rest of the coil intact. Depth control is sufficient to cut into the thin (1-2 um) layer of adhesive that attaches the copper to the flexible substrate. The minimum feature size is 300 um line width and 100µm spacing.
- The metal shavings are collected and can be sold to recyclers, providing a small additional income stream rather than the costs associated with disposing of etchant fluid.
- Conventional post-processing steps can be performed - these include low temperature soldering, lamination, marking, electrical measurement for quality control, etc.

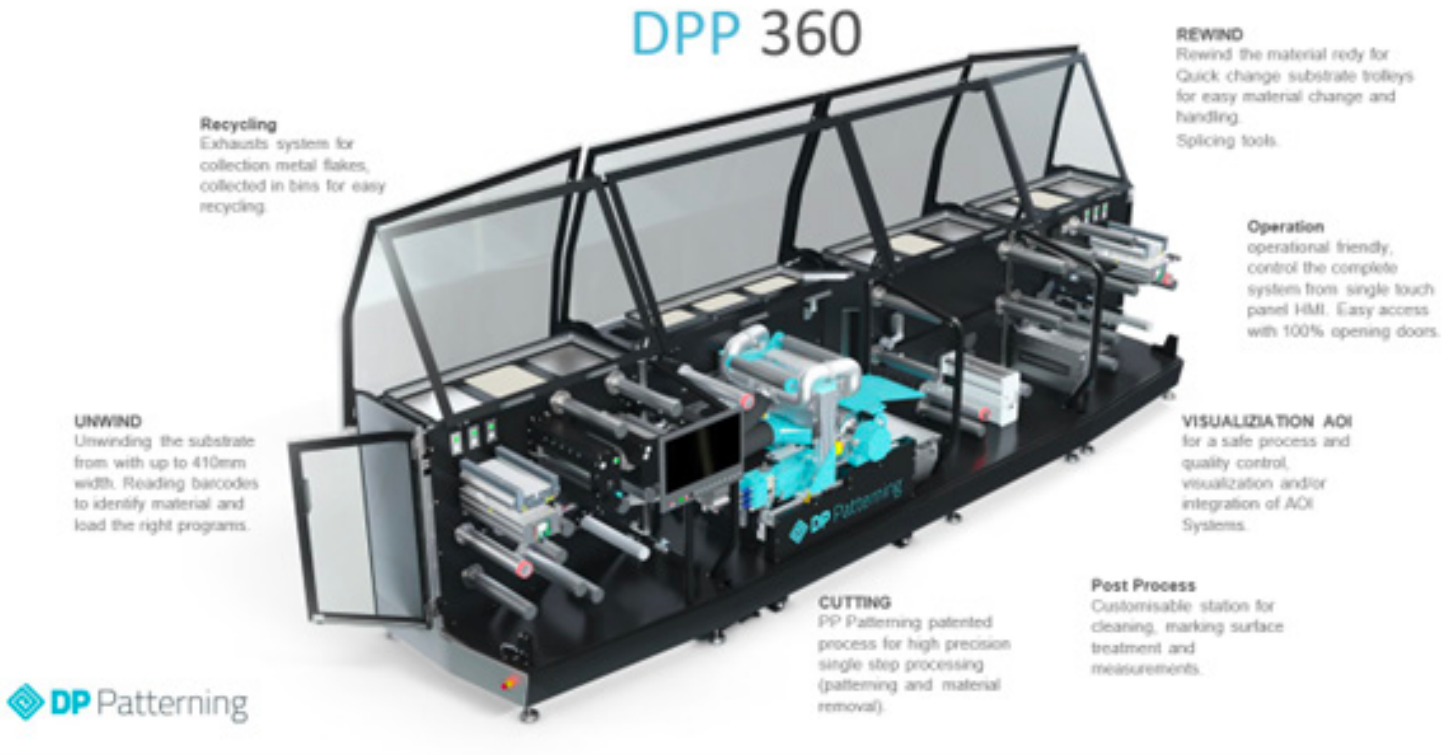
The dry phase patterning process and patterned copper laminate film (in this case heating elements) are shown below.





Source: DP Patterning

An illustrative example of DP Patterning's roll-to-roll patterning machine is shown below. Note that the machines can each be built to specific customer requirements.



Source: DP Patterning

This 'dry phase' patterning technology brings multiple benefits:

- High throughput of 30m per minute (max web width of 410 mm), with reduced running costs relative to etching.
- Substantial reduced energy consumption, as the purely mechanical process means that no heating of an etchant is required.
- Unlike etching lines with their corrosive chemicals, the system can be installed alongside pick-and-place and converting equipment.
- Cliché roller pattern can be produced on-site within 45 mins of a design being submitted, facilitating prototyping. Lead times relative to etching at a different (often overseas) facility are much reduced.
- Relative to printing conductive inks, traces are pure metal with sharp edges, so highly conductive even at high frequencies.

One limitation of the dry phase patterning system relative to conventional methods is that today there is a minimum feature line width of 300 um.

Business model and market

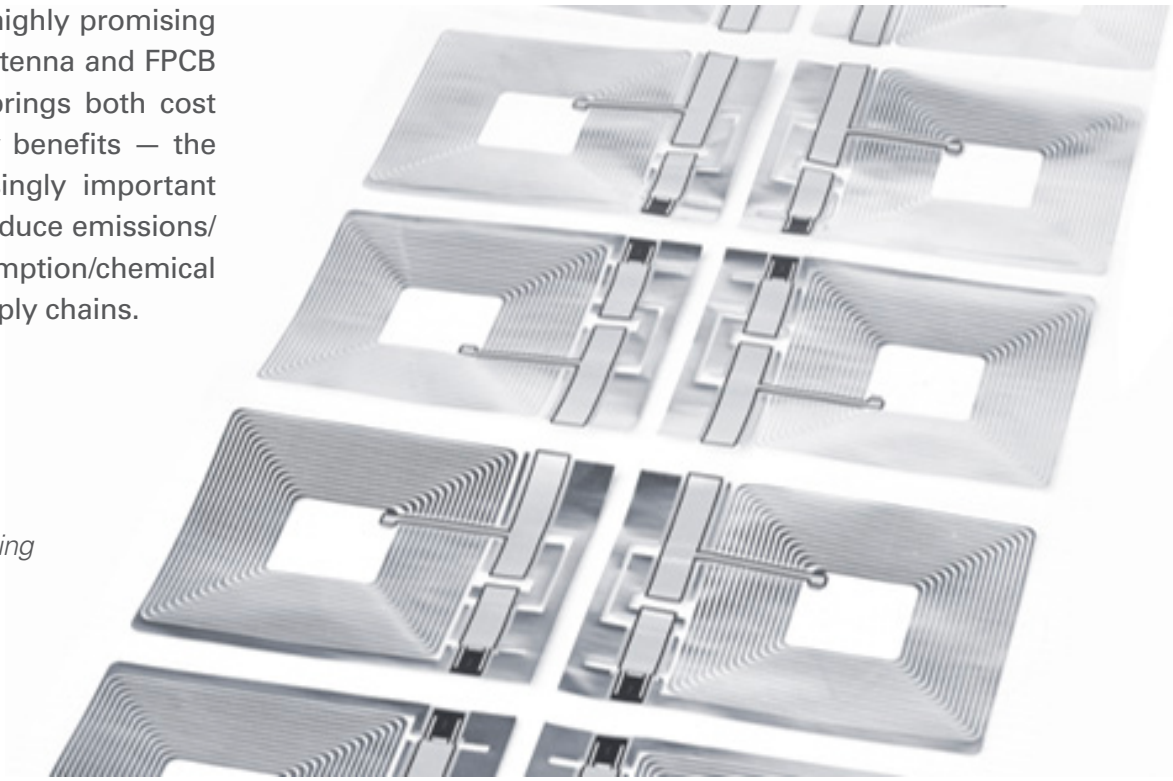
DP Patterning's business model is to build and supply equipment to companies manufacturing FPCBs, which is then used under license. The manufacturing equipment is built by DPP at its HQ in Sweden, using components from a range of suppliers.

As well as equipment sales, DP Patterning has a few other revenue streams. These include providing after-sales support for its equipment, along with prototyping and development services using the pilot line at its HQ.

Multiple markets have been identified as promising for this FPCB patterning technology:
-RFID antennas. Currently these are produced by either stamping, etching, or printing. Dry phase patterning offers an additional low-cost, high-throughput, more sustainable method.
-Automotive applications. These include heaters, interconnects, and battery management systems (BMS) for electric vehicles (EVs).
-Antennas. The first application for dry phase patterning was RFID and essentially all antennas can be produced with this method. DP Patterning offers the application and system supplier a strategic change of sourcing of RFID circuits, including antennas, by implementing in-house production of the component. Our partner on the RFID market is Mühlbauer GmbH. For 5G. a new concept of the production of 'radio stripes', specifically multiple antennas on a long strip of flexible thin film have been tested with a telecom company. These are described as a 'next generation 5G base stations', and with the multiple antennas improving reception in high traffic areas such as stadiums and stations.

An example of antennas produced using dry phase patterning is shown below.

Overall, this is a highly promising technology for antenna and FPCB production that brings both cost and sustainability benefits — the latter are increasingly important as OEMs try to reduce emissions/ energy consumption/chemical waste in their supply chains.



Source: DP Patterning

Company Profile: DP Patterning

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Matthew is a Senior Technology Analyst at IDTechEx, specializing in printed/organic/flexible/hybrid electronics. Matthew has previously been involved in academic research across a wide range of printed/flexible electronics topics, contributing to 15 scientific papers in well-respected journals and with an h-index of 9. As such he has a comprehensive understanding across the printed/organic/flexible electronics field.

Matthew analyses technical innovations and applications across the printed/organic/flexible/hybrid landscape, publishing his analysis on the IDTechEx portal and in reports. He is based in London, UK.

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