

Printed logic and memory

Low-cost and flexible printed electrical memory for data-card applications

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Printed logic and memory is projected to gain a significant market by the end of this decade, with relevant application areas ranging from simple data-carrying cards to programmable RFID tags. VTT has developed a fully roll-to-roll printable electrical memory based on patented nano-particle sintering technology.

Successful product prototype demonstration

In 2011, VTT printed a pilot series of ten thousand memory devices using roll-to-roll flexographic printing as shown in Figure 1. The memory units were used in 1,000 electronic voting cards that were fabricated with Stora Enso Corporation for conference-organiser

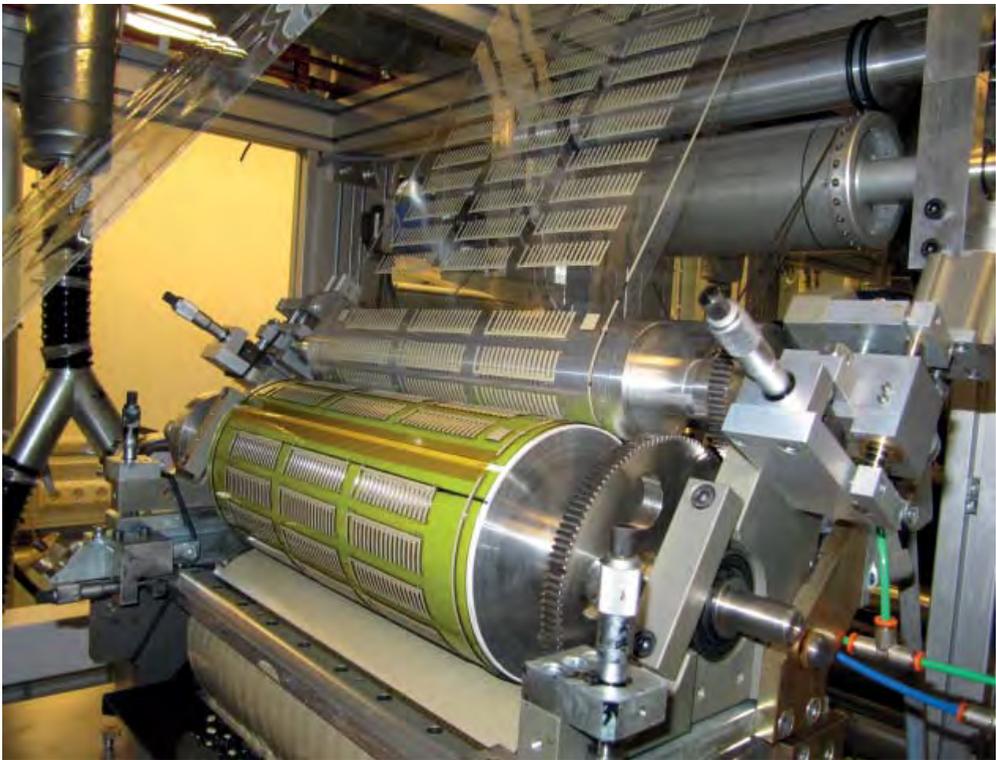


Figure 1. Roll-to-roll printing of memory bit arrays on PET substrate.



Figure 2. Electronic voting card used at IDTechEx Printed Electronics Europe 2011.

IDTechEx (Figure 2). The voting cards were distributed to visitors to the Printed Electronics Europe 2011 conference for selection of the best exhibition booth. VTT was behind the readout of the votes stored on the cards, using a bespoke contact reader. The battery inside the card used for memory programming was made by Enfucell, and the ink used for the memory bits came from Advanced Nano Products.

Enabling data-carrying and programmability by printing

The advantages of VTT's roll-to-roll printed WORM memory technology include:

- Low cost per bit of memory, achieved via minimal usage of nano-particle ink
- Low-voltage programmability enabling applications that utilise printed batteries
- Flexibility and integration possibilities for various substrates
- Demonstrated data retention times of months

Printed electrical memory for various applications

The write-once, read-many operation of the printed WORM is convenient in applications wherein data are written only once, for one or more readout operations. These applications include:

- User-feedback forms such as the voting card or 'smart packaging' products
- Event-detecting sensor applications such as moisture sensors inside building walls or event-loggers for supply chains
- Product ID or tag applications in which the content of the code needs to be written after fabrication

Memory R&D and commercialisation activities VTT is developing the WORM technology further to reduce the writing voltage required and to increase data storage times. VTT develops client specific product prototypes like the voting card and is seeking partnerships in R&D and commercialisation of such applications.

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