A3Ple
Autonomous
Printed Paper Products
for Labels & Electronics

SEVENTH FRAMEWORK PROGRAMME

Framework & Partnership

This project A3Ple is SME focused collaborative project funded by the European Community's 7th Framework Programme under grant agreement n° 262782 (APPLE). This project associates 12 partners from 6 European countries and is coordinated by CTP. *More information is available on A3Ple public website:* ***www.a3ple.eu***

Work improvement by work package (WP)

WP1

Final versions for (1) End-user and technical specifications and (2) materials and components specifications have been completed for the three targeted demonstrators.
Methodologies for testing LCA, recycling, environmental and reject issues of materials, components and demonstrators have been defined. LCA was performed to compare FS paper to FR4 (Plastic for conventional electronic): CO2 impact factor is 1000 lower for paper.

WP2

Three reference papers were selected, their printability in relation to the functional and peripheral components were tested. At M18, requested properties converge into one paper reference that will be upgraded in order to increase runalibity at industrial scale. Five polymers have been selected to substitute the PE coating and tested at laboratory scale. Their biodegradability tests are on progress.
The study of the paper properties on the transistor behaviour has started; 2 kinds of papers have been found that appear rather suitable for transistor and memory components. Use of NanoFibril of Cellulose seems to be promising.
Flexographic silver ink is validated as conductive ink. For the display, the transparent conductive ink is under testing in WP3.

WP3

Battery structure and associated manufacturing processes have been defined. Prototypes have been realized at laboratory scale to validate both material and process. First trials have been performed at industrial scale with no functional electrolyte. The next step is to define the electrolyte filling.
Sensors: the development of CO sensor based on CNT (Carbon NanoTube) has started on a water base ink formulation. First prototype on FS papers has already been done at lab scale with spay technique. The H2S sensor is developed according to literature published (Crowley and all). The design of temperature sensor has been tested at lab and industrial scale. Further investigations are still going on to improve the sensitivity.
Display: Ink development of active layers and their associated processes are tested with success and validated at pilot scale. Active layers will be printed on Conductive PET/ITO. The display-label will be hybridized. The next step will be to replace ITO by transparent conductive layer.

WP4

Active components. An alternative concept of transistor has been agreed in order to make a fully printed transistor. Transistor effect on EGTFT configuration has been shown with sputtering ZnO as semi-conductor. All the other layers are already printed. Development of ZnO ink is going on.
Passive components. Resistors values range has been defined and printed using flexographic water base inks, at laboratory and industrial scales. Resistors with target value were introduced with success on demo 1's and demo 2's printing circuits.

WP5 &6

The electrical circuit based on electrical behavior of each printed component has been built for demo1 and demo2. Connections, resistors and component pads were printed at industrial scale. Then a hybrid circuit was made with this and Si based sensor, transistor and display. The **hybrid-Demo1-V1 and V2** and the **hybrid-DEMO2-V2** work as expected proving both printing and electrical integration efficiency!
Industrial printing test runs were achieved at LT factory in order to transfer the results of the previous WP. A first visual inspection system was planned, manufactured by ICS and installed at LT.

WP8

The hybrid-Demo 1 was presented at OE-A competition organized on LOPE-C 2013 in München (fig on the right). A3Ple consortium will be present at EMRS on September 2013.

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