

Feasibility Project

Lithographically Printed Voltaic Cells

Brunel Univ., Rohm & Haas (left April 2006) Electronic Materials, Arjo Wiggins Fine Papers, Dupont Teijin Films UK

This proposal is to support research into the fabrication of voltaic cells (electric cells & batteries) by the offset-lithographic printing process, and in particular flexible planar electric power sources. Our research group has previously conducted several successful research projects in which offset-lithography (a technique used to print books and magazines) has been adapted to manufacture electronic components and circuit interconnects on a wide range of flexible materials such as paper and polymer films. Offset-lithography uses hydrophobic patterns on a printing plate to define the printed image. Conductive Lithographic Film (CLF) circuits are fabricated by printing conductive inks onto the surface of paper-like substrates using the offset-lithographic printing process, and were first developed by the cleaner electronics group at Brunel University as low-cost and low-environmental impact alternatives to copper-clad FR4 boards and thick-film circuits. CLF circuits have proved suitable for a number of applications, including planar microwave integrated circuits, filter structures, and switch pads in keyboard matrices. More recent work has concerned the development of additional lithographic ink formulations carrying other electronic materials. We have established that composite structures containing conductive, resistive, dielectric, and ferromagnetic layers can be manufactured entirely by offset-lithography, which has resulted in printing techniques for composite capacitors and microwave structures. Printed thermistor elements have been formed by lithographically depositing intrinsic semiconductor films in conjunction with CLF conductors. Printed electronics substrates offer significant cost advantages and environmental benefits over conventional etched copper-clad laminate circuit boards. If the applicants are able to demonstrate proof of concept, this will lead to the development of commercial products and processes, which will help to move printed electronics up the 'slope of enlightenment'.

A printed battery, made from a group of cells (Figure 1), has been produced able to power a microcontroller-driven LED display system (5v @ ~5mA) for more than three hours (Figure 2). Further work seeks to improve cell capacity, address manufacturing process issues, and characterise the structures in more detail.

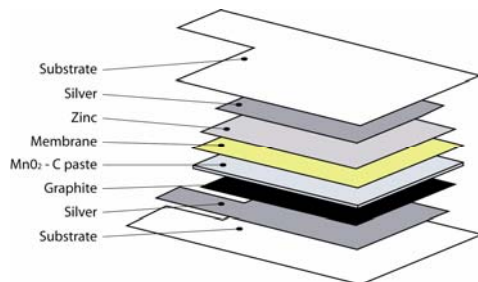


Figure 1. Cell configuration

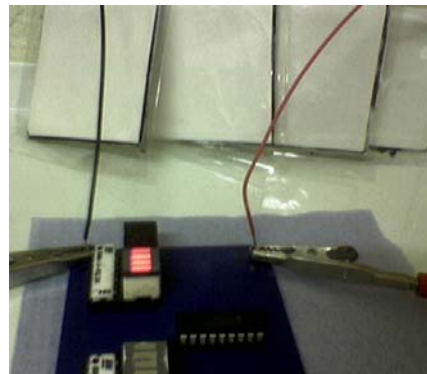


Figure 2. Lithographically printed battery powering 'conventional' circuit

Contact: Darren Southee, Cleaner Electronics Research Group, Brunel University, UB8 3PH
Email: Darren.Southee@brunel.ac.uk Tel No: 01895 266323