

SYSTEM INTEGRATION

In-line quality control of UV offset lithographically printed electronic-ink by THz technology (IQ-PET)

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The project is to investigate the changes in THz spectra at each stage of the UV Offset printing process for electrically conductive and dielectric inks. This will guide where best to site THz sensors in a commercial offset press to achieve real-time In-line Quality-control for UV cured offset lithographically Printed Electronic-Ink by THz technology (IQ-PET). We use lab-developed, standalone systems (THz quasi-optical reflectometry), and commercial THz TDS (time domain spectroscopy) and antenna Near-field Scanning (NSI) systems to develop quality control system which can operate with high-speed sheet-to-sheet and roll-to-roll production lines for system level integration in large-area electronics manufacturing.

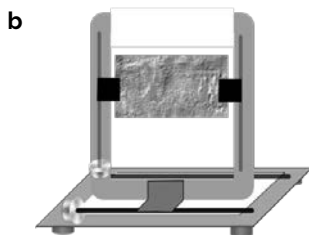
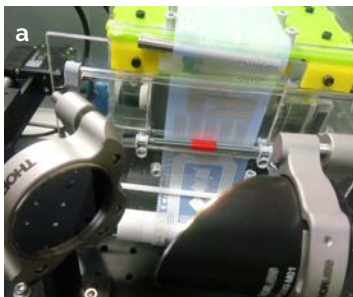
The Objectives of the project were to investigate the changes in THz spectra at each stage of the UV Offset printing process for electrically conductive and dielectric inks.

The system synchronisation presented challenges. For a typical industrial 0.5m/second press speed, the THz system would need to complete a scan in 0.01 seconds to achieve a synchronous match.

During the project, 4 types of THz based quality control prototype and data analysis software package were demonstrated and compared with pros and cons. A paper "Terahertz characterisation of UV offset lithographically printed electronic-ink" has been published in Organic Electronics, vol 48, 2017, p382-388.

The software and hardware developed from this project would be ideal prototype with further amendment for industrial practice; the improvement of spatial resolution of THz scanning and the physics between materials' properties with ink quality would be potential research direction for application of EPSRC project in manufacturing.

a) THz -TDS system combined with 1D Conveyor which includes stepper motor controlled roller, acrylic feet for attaching to the THz rig, freely moving roller, aluminium plate with cylindrical guides and steel rods on either end. b) 2D Conveyor and c) its prototype which includes stepper motor with screw rod for x-axis motion, stepper motor with screw rod for y-axis motion, rubber shocks and polished aluminium plate.

**Industry interaction**

The project solves the frequently-demanded requirements from printing industries: non-contact, fast speed quality control. THz can supply the imaging mapping, and further quantified dielectric and conductive parameters other technologies cannot offer.

Nano Products Ltd was closely involved with this project and they are very satisfied with the quantified dielectric analysis of their inked products at different stage.

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