European Metrology Research Programme

Delivering Impact

EURAMET

High-performance thin film technologies

Lower costs and improved reliability in the manufacturing of thin films have enabled the development of a huge range of high-value technologies, from electronic displays to solar cells. However, many new thin-film technologies are highly sensitive to degradation from exposure to air and moisture, and improved measurement techniques are needed to support the cost-effective production of protective barrier layers and keep Europe at the forefront of this high-value sector.

Europe's National Measurement Institutes working together

The European Metrology Research Programme (EMRP) brings together National Measurement Institutes in 23 countries to address key measurement challenges at a European level. It supports collaborative research to ensure that measurement science meets the future needs of industry and wider society.

Challenge

Barrier layers, used to increase the lifetime of sensitive thin-film products, are currently manufactured in ultra-clean rooms to avoid introducing defects through which water can permeate. These facilities are expensive to maintain, contributing to around 40% of total production costs. To assess the suitability of alternative, more cost-effective production techniques, measurement facilities are needed which can reliably characterise the performance of barrier layers and determine whether they provide adequate protection for the products.

However, for advanced applications, barrier layers must be capable of protecting the encapsulated product from extremely small amounts of water vapour. For example, organic LEDs used in phones and televisions need barriers capable of preventing the ingress of even a few micrograms per square metre per day – roughly equivalent to one drop across an area the size of a football pitch over a month – if they are to achieve acceptable product lifetimes. Current measurement techniques cannot detect the transmission of such small amounts of water vapour through films.

Solution

The EMRP project *Metrology for the manufacturing of thin films* has developed a new facility which allows users to measure the water vapour transmission rate through barrier layers accurately and traceably at the low levels required by industry. The facility and associated measurement method was validated in an international comparison exercise, organised in collaboration with the Organic Electronics Association, and applied to commercial barrier layers to provide vital information about the effect of manufacturing conditions on barrier layer quality.

Impact

One of the first users to benefit from the new facility was Plasma Quest, a developer of thin film materials and deposition technology for customers in the electronics industry. Plasma Quest used the facility to test barrier layers made using different production techniques and successfully demonstrated a new technique which enables high-volume production of barrier layers whose performance is unhampered by any dust in the production environment.

The ability to create effective barrier layers without the expense of maintaining clean room conditions will significantly reduce manufacturing costs without any reduction in product performance. Plasma Quest has already received enquiries from several manufacturers of mobile phone screens looking to upscale the new technique.

Plasma Quest is just one of the early adopters of the new facility established by the project. The precise characterisation of barrier layer performance it enables will support the development of durable thin film devices, leading to significant cost savings for industry, reducing product prices and opening new markets.

Metrology for the manufacturing of thin films

The EMRP project *Metrology for the manufacturing of thin films* developed new methods and advanced reference materials to support quality control in thin film manufacturing. By supporting reduced costs and time-to-market of innovative products based on thin films, the results of the project will help to maintain European leadership in the multi-billion euro global market in thin film optoelectronics, including printed electronics and display screens.

EMRP
European Metrology Research Programme
Programme of EURAMET

The EMRP is jointly funded by the EMRP participating countries within EURAMET and the European Union

www.euramet.org/project-IND07

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