

## Publishable JRP Summary Report for Project IND 07 Thin Films Metrology for the manufacturing of thin films

The manufacturing of thin films is of key importance since it underpins a significant number of industries where Europe holds a leadership position. Of strategic importance for the EU are high value thin films used in the optoelectronics industry, such as plastic and printed electronics, displays and lighting, memories and solar cells.

Improved production quality, aligned with reduced costs and time-to-market of new products, is necessary to maintain European leadership in the multi-billion Euro worldwide sector of thin film optoelectronics. **The major challenge is control of consistency in thin film processing.** The use of **large areas** is a key competitive advantage of thin film technology, however it carries significant challenges, namely the need for strict quality control methodologies in order to detect variations due to process drift or local defects. Currently, the development of measurement methods occurs independently, not taking into account the interrelations among film properties. To support industry and to ensure thin film manufacturing quality control, **validation and traceability** of measurements of thin films properties need to be established and methods for accurate characterisation of film **microstructure** need to be developed.

The aim of this project is to establish a pan-European metrology capability with the goal of providing validated and/or traceable metrology for: thin film materials properties; composition and structure; and for controlling large area homogeneity and consistency of properties. This JRP will develop the necessary metrology to control consistency of thin film processing and improve production quality in order to reduce costs and time-to-market for new products.

To this end the project brings together a select group of Partners from national measurements institutes, designated institutes, industry and academia. This group will develop prototypes for advanced large area thin film characterisation, novel advanced microstructure characterisation tools and reference standards, and validated and traceable measurement setups that go beyond the state-of-the-art. The technical work is divided in three work packages. The first one is devoted to validation and traceability of new measurement methods with increasing resolution. This will provide novel and improved capability to support the thin film industry with accurate materials properties off-line characterisation and will also support development of in-line tools within the other work packages. The second work package is centred on the development of X-ray and Raman spectroscopy based methods for the characterisation of thin film microstructure. These techniques have been used in industry but are not yet adequate for complex multicomponent thin films. In particular we will ensure accuracy of 2D and 3D profiling measurements, which is essential for the quality control of thin film manufacturing and for the development of new thin film technologies. The third work package focuses on large area and multiscale measurement methods to characterise relevant industrial thin film samples. One advantage of thin films for optoelectronics is the ability of large area processing, however layer thickness and device parameters need to be controlled accurately in order to ensure consistent production quality. This work will provide measurement solutions for that with the development of prototypes in collaboration with industry partners and stakeholders.

Through focused, efficient and effective means of knowledge transfer and close collaboration with industry and other stakeholders, the new measurement methods and the new reference materials developed under this project will support high-quality, cost-effective manufacturing, will facilitate product development, reducing time-to-market and, therefore, will increase competitiveness of European industry.

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JRP-Partner 7	VSL, The Netherlands
JRP-Partner 8	INMETRO, Brazil
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