3DMetChemIT

Advanced 3D chemical metrology for innovative technologies

The need

"Faster", "smarter" and "cheaper" demands from consumers are driving innovation in high value-added manufacturing. To achieve this, industry is increasingly using 3D architectures, additive manufacturing and a rapidly expanding library of materials. This is equally the case for devices based on organic materials, such as smart optical films and advanced coatings, as it is for inorganic nanolayered high-density 3D-devices. In many technologies, e.g. sensors and semiconductors, the interface between organic and inorganic materials causes severe measurement issues. This creates an urgent need for beyond state-of-the-art capabilities to measure chemical composition and interfacial properties with 3D-spatial resolution

HIGH-DENSITY SEMICONDUCTOR DEVICES

- Standards and 3D metrology urgently needed
- €20 billion EU nanoelectronics + 250000 jobs

MEDICAL DEVICES

- European market at over €70 billion annually
- Failure rates undesirably high

ADDITIVE MANUFACURING

- 3D printed tablets expected to revolutionise personalised medicine

ORGANIC PHOTOVOLTAICS

- With controlled nanostructures solar energy could provide up to 30% of world energy

LIGHT MANAGEMENT FILMS

- > €3 billion global annual sales
- Inclusion defects at buried interfaces are major issue

Objectives

- Advanced metrology capability for chemical 3D imaging of organic and heterogeneous devices with high-spatial and high-mass resolution.
- Metrology and development of standardisation for atomic resolution 3D elemental imaging of inorganics.
- 3D chemical imaging of irregular devices and complex organic-inorganic interfaces.
- Advanced metrology capability for accurate chemical identification of defects and buried interfaces.
- Calibration standards, 3D nano-structured reference materials and traceable quantification methods for 3D structured devices.
- Uptake of the metrology and measurement infrastructure by industry. Enhancing the competitiveness of EU industry.

Metrology Challenges

WP1: Metrology for 3D characterisation of buried interfaces and defects

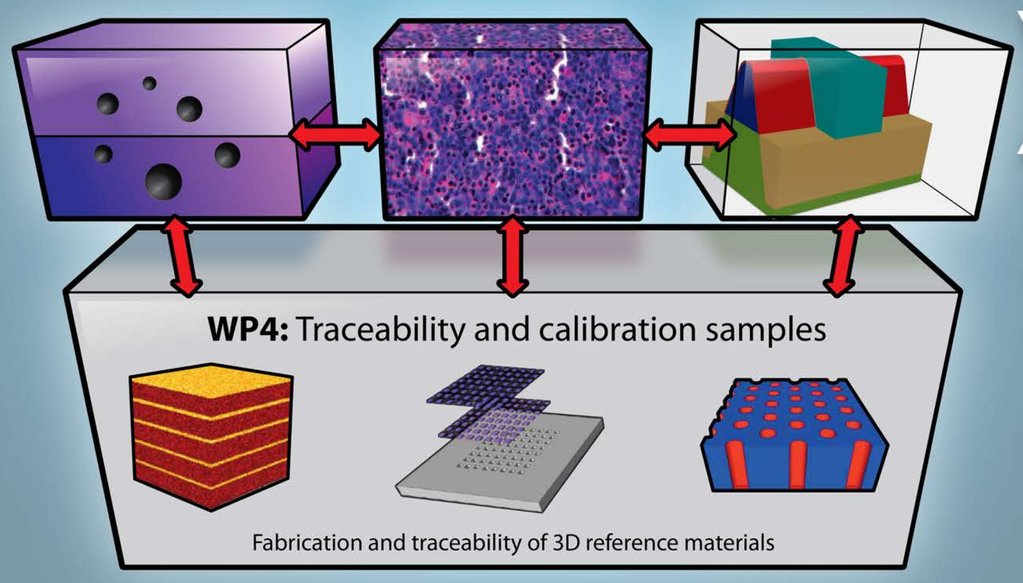
- Innovative 3D nanoSIMS >100000 mass resolutionand <100nm spatial resolution

WP2: Metrology for 3D nanoscale structures

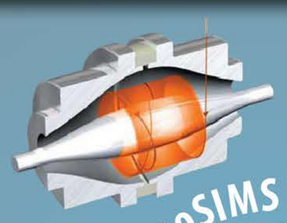
- Unique 3D Topo-SIMS for nano-scale chemical imaging

WP3: Metrology for Heterogeneous devices

- Essential metrology for atom probe tomography

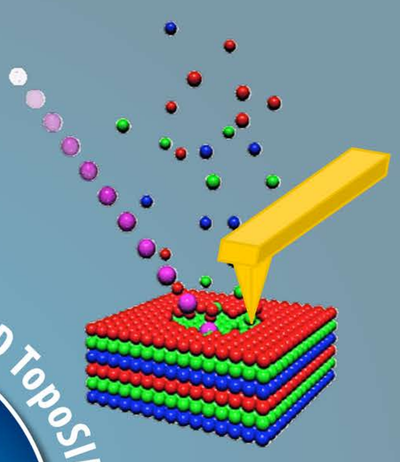


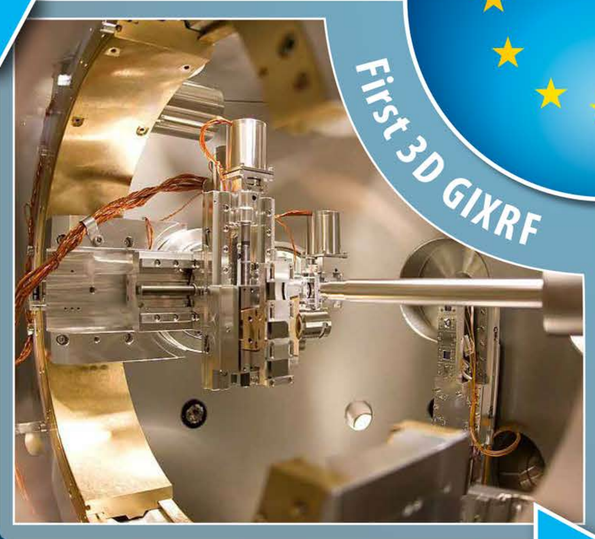
Beyond state-of- the-art: EU world leading metrology



First 3D nanoSIMS

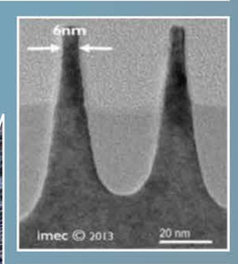
First 3D ToposSIMS

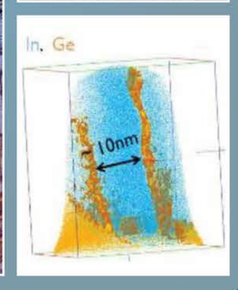




First 3D GIXRF

First VAMAS study on APT





Creating Impact

- Webinars
- e-Learning
- Metrology training

- Standards
- CCQM pilot study
- Reference materials
- Measurement guides
- VAMAS study

IMPACT

- High-impact science
- High-profile publications
- Conferences
- Workshops

- Industry network
- Industry workshops
- Digital magazine
- Stakeholder group

Industry Focus

- Strong industry engagement with leading and emerging EU industries
- Industry focused impact using webinars, e-Learning, training, guides
- Case studies from industry to prove metrology performance on real world examples
- Dedicated instrument access for industry benefits realisation and training
- Industry-led stakeholder group to steer the project

National Physical Laboratory · imec · PTB Physikalisch-Technische Bundesanstalt Braunschweig und Berlin · CMI · IONTOF · The University of Nottingham · cpi · FCT Faculdade de Ciências e Tecnologia Universidade Nova de Lisboa · UPO Università del Piemonte Orientale · CNR - IMM Laboratorio MDM · INRiM Istituto Nazionale di Ricerca Metrologica