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Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA
INFN

ET-Padova research unit: coatings research infrastructure

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INFN PADOVA

Università degli Studi di Padova

ET-Italia: 1º Workshop on Coatings

Rome 30/05/2024

ET Padova research unit

Research lines:

- Straylight control (L. Conti, G. Ciani)
- Coatings (M. Bazzan, G. Ciani)
- Squeezing (G. Ciani, J.-P. Zendri)
- Cosmology (S. Matarese, N. Bartolo, M. Peloso)

Personnel:

38 Members of the ET Collaboration are currently associated to Padova Research Unit

Staff and associated INFN, UNIPD-DFA, INAF personnel

ET Padova research unit - coatings

UniPD

- Marco Bazzan (Associate Professor)
- Giacomo Ciani (Associate Professor)
- Hanna Skliarova (Tecnologo)
- Valeria Milotti (RTDa)
- Nicole Busdon (PhD)

INFN-PD

- Jean-Pierre Zendri (Primo Ricercatore)
- Livia Conti (Prima Ricercatrice)
- Massimiliano Bonesso (Tecnologo)

Strong synergy with the other research groups of the area involved in research of gravitation waves and material science.

The CoMET laboratory

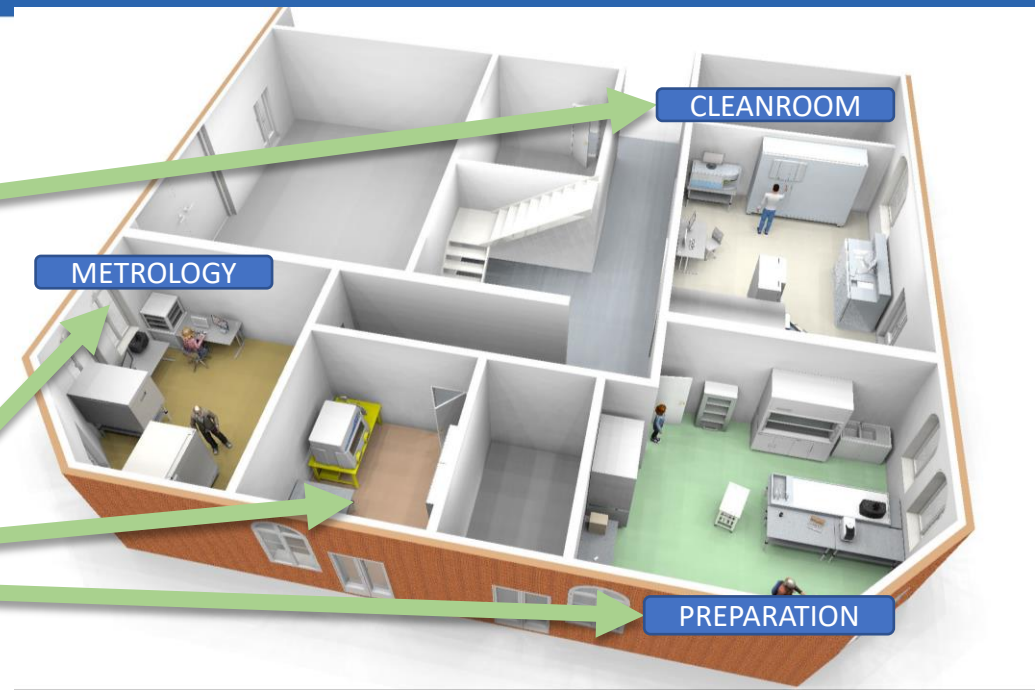
CoMET = **Co**ating **M**aterials for **E**instein **T**elescope

Mission: Production of high-quality research samples with highly controlled conditions to enable the study of new amorphous coating materials.

- Facility funded by ETIC (INFN)
- Co-funded **University of Padova**
- Managed by the **Padova INFN section** and **University of Padova** (Co-Participant)

CoMET's goals

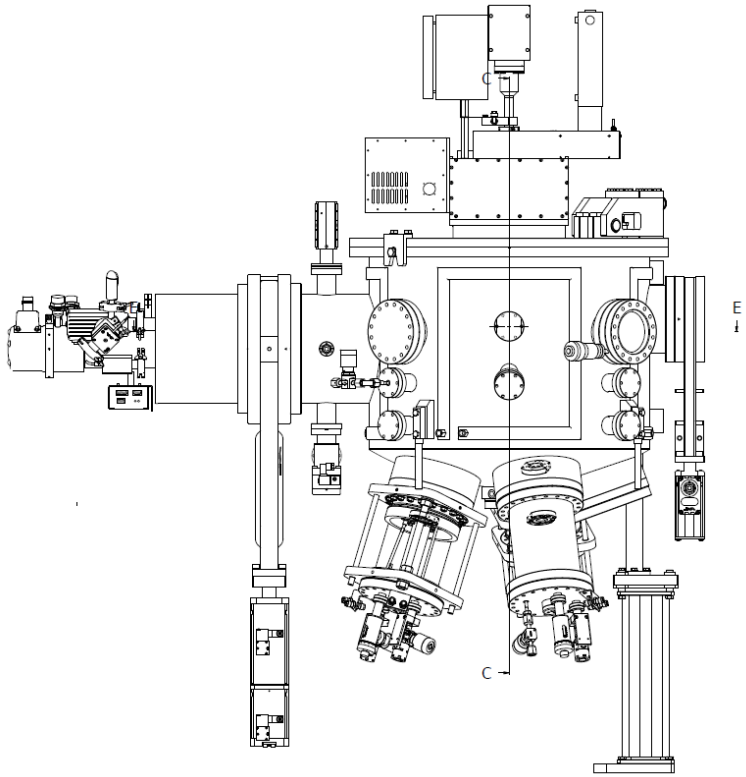
- Deposit **different materials** with **various technologies** (2 deposition machines at the beginning) and wide range of deposition conditions
- Focus on **control and reproducibility** of deposition conditions
- **Supply each produced sample with a «characterization chart»** where all meaningful parameters are routinely measured.
- Keep **tight control of cross-contaminations**.



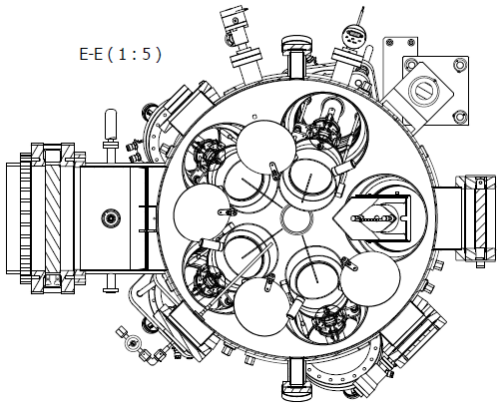
- Open to **collaboration and proposals**: guest scientist will be encouraged to request sample production and/or visit for direct access to the equipments

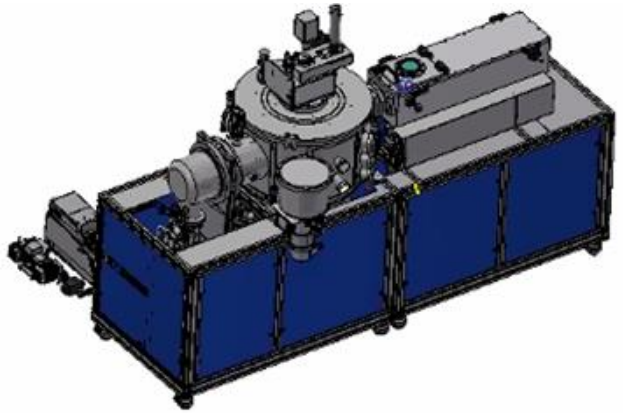
Deposition facility 1: Magnetron Sputtering

Kenosistec customized cluster MS system.



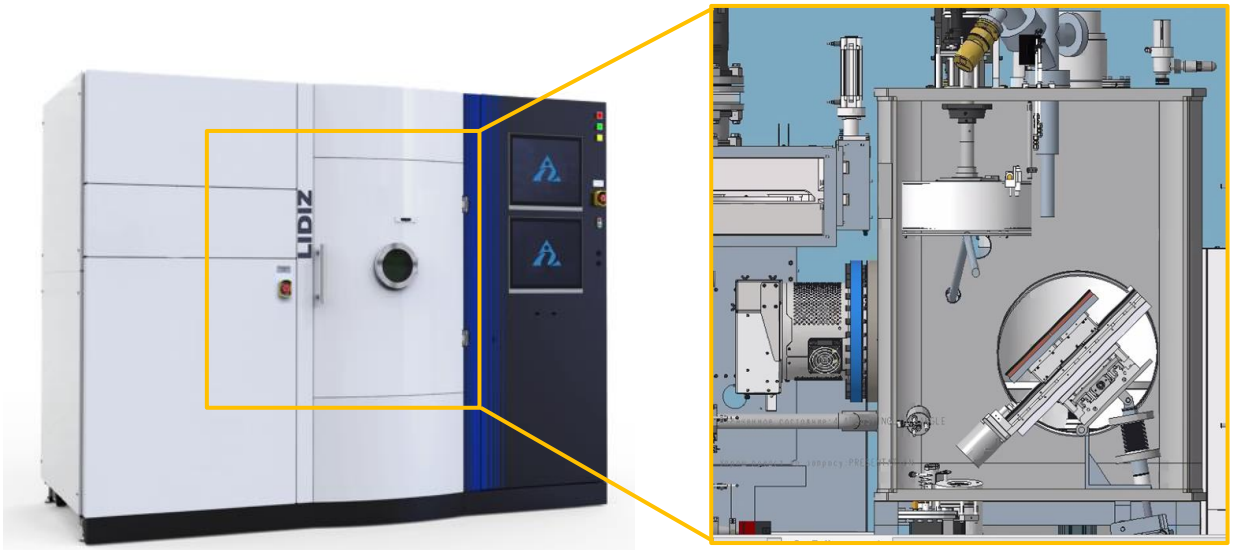
- 4 4'' **magnetron sources** for co-deposition (for now 1 pulsed DC, 2 RF power supplies)
- **Assistance ion source** eH200HC (non yet, but additional funds were requested)
- High **vacuum** ($< 6 \times 10^{-8}$ mbar)
- 5 **gas lines** (Ar, O2, N2, ..) each can be used near magnetron or/and near substrate
- **Uniformity** better than 1% on 100 mm diameter
- **Substrates** up to 125 mm diameter, up to 20 mm thickness
- Rotated **substrate holder**, heating up to 700°C
- Predisposition for RF susbtrate **bias**
- Predisposition for several **in-situ diagnostics**: RGA, ellipsometry, *energy-mass spectrometry, stress/curvature measurement, optical(photon) emission monitor, ..*





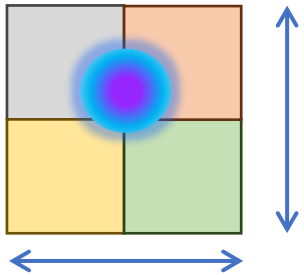
Deposition facility 2: Ion Beam Sputtering

I-Photonics LIDZ customized IBS system



- Multimaterial deposition with compositional control up to 4 different **targets** (each can be multicomposition).
- **Primary ion source** 400 mA 2000 eV,
- **Assistance ion source** 2A, 450eV
- High **vacuum** ($< 1 \times 10^{-7}$ mbar)
- High purity **gas lines** for each source and neutralizer
- **Substrates** up to 125mm in diameter, several mm thickness
- **Uniformity** better than 0.5% on 100 mm diameter substrates
- Rotating **sample holder**, heated up to 700°C, 10cm ΔZ position
- Predisposition for several **in-situ diagnostics**: ellipsometer, RGA, *mass-energy spectrometer, optical(photon) emission monitor,* optical thickness monitor, ..

Target movements for composition and angle control



Other equipment for CoMET

Semilab inSE-1000
in-situ ellipsometer

Semilab SE-2000
ex-situ ellipsometer

EDS probe for SEM Quanta 450
(@Te.Si. lab, near CoMET)

Leyspec Cart Leybold
Residual gas analyzer

Annealing oven
Gero Carbolite TF1 12-125-800
1200°C, vacuum, air, gas flow

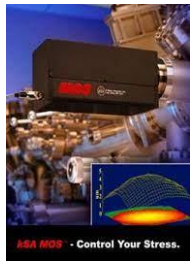
Digital microscope
objective (@Pd)

Some equipment already available temporary placed in nearby labs, will be eventually integrated into CoMET

Future needs for CoMET

Add-ons for deposition machines

- EH200HC Kaufmann assistance ion sorce for MS
- HIDEN SQP9 mass-energy spectrometer
- RF, pulsed DC power supplies
- In situ curvature/stress measurement system
- OEM/PEM
- NIR extention ellipsometer



Sample preparation / processing

Lapping machine

Ion-milling

Sample characterization

AFM

XRD/XRR

The Padova thin-film science ecosystem

CoMET will be located in a favorable environment, benefitting from the interaction with local high-class infrastructures

Physics Dept.

Chemistry Dept.

- Chemical labs
- Dig. optical microscope
- Scatterometer
- XRD
- Raman
- FTIR
- AFM
- RTA
- SIMS
- Laser annealing
- UV-Vis spectroscopy
- XPS
- NMR
- SEM, EDS

Ready to use
By calendar booking
Request to a dedicated personnel or collaborators

CoMET - Rovigo

CNR - INFN Padova

- Reflectometry

- High-resolution ellipsometry

Engineering Dept.

INFN Legnaro National Laboratories

- AN2000 for IBA (RBS; ERDA)
- SEM, EDS, FTIR, RF MS

CoMET Timeline

	2023						2024						2025		
Building												M1			
Lab/Cleanroom													M2		
Equipments															M3
Furnitures													M4		

1. Building renovation completed, including plants (HVAC, cooling fluids, electric, …)
2. Cleanroom and laboratory environment completed
3. Deposition equipments installed and tested
4. Laboratory and office furnitures installed

See you soon at our CoMET lab!