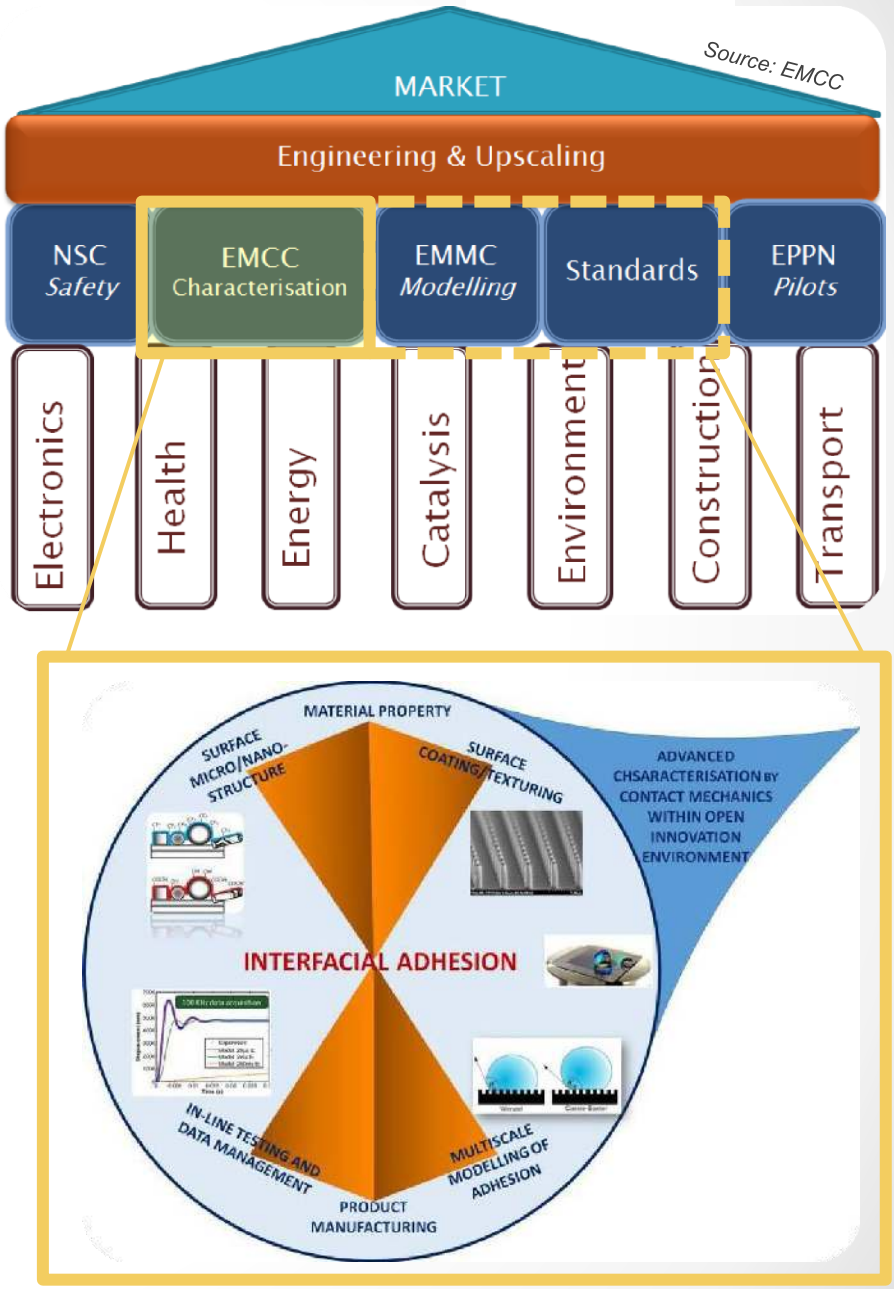
This project has received funding from the European Union's Horizon research and innovation programme under gran agreement No 760827.

OPEN CHARACTERISATION AND MODELLING ENVIRONMENT IN NANOARCHITECTURED HARD/SOFT INTERFACES

(Marco Sebastiani – coordinator)

Oyster Mission

- **Nano-enabled** materials can improve **adhesion and friction properties** of current products
- Current tools and methodologies have **failed to produce a standardised approach** to control nano-adhesion (so far)
- Coherently with EU vision, OYSTER studies the **triangle of manufacturing, modelling, and characterisation**, aiming at developing an **Open Innovation Environment** for a faster spread of advanced nanoarchitectured materials with controlled adhesion



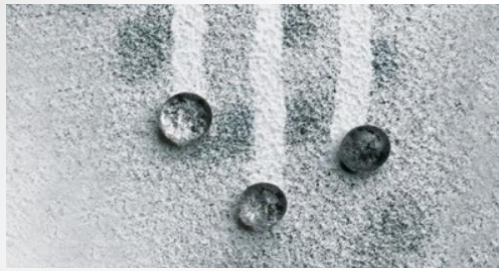
OYSTER consortium

- A broad variety of **stakeholders** in the field of **material characterisation** are present in the consortium: 4 universities, 2 research institutes, 1 large company, 7 SMEs
- The following skills are available:
  - Nanomechanical **testing;**
  - Multi-scale materials **modelling;**
  - **Standards** development;
  - Surface **functionalisation;**
  - **Biochemistry;**
  - Surface **nano-patterning**;
  - Polymer synthesis;
  - Instruments **manufacturing;**
  - Innovation & data **management.**

H2020 – OYSTER WIDER IMPACT

Applications of Low-Free-Energy surfaces

- **Self-cleaning** properties

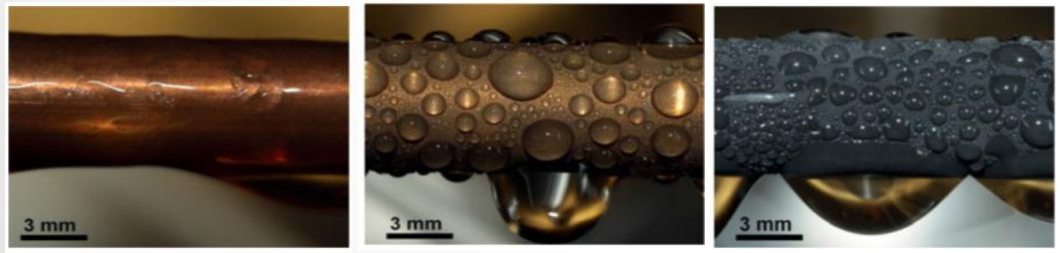


- Improvements of **glass performances** for optronic devices

- **Friction reduction**

- **Anti-icing** performances

- **Enhancing** of **the heat transfer** coefficient

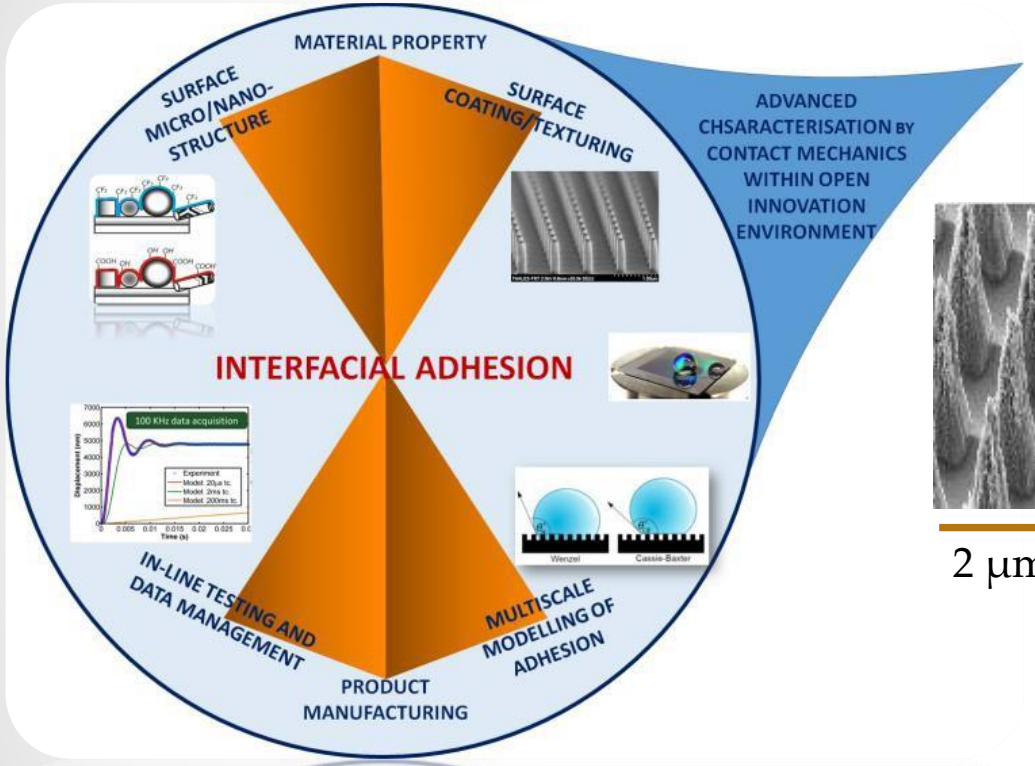


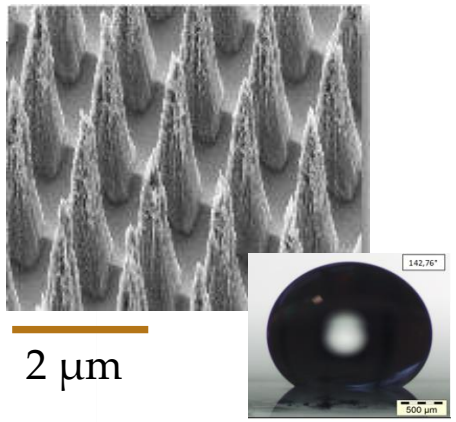
- Improving the contact lens **resistance**

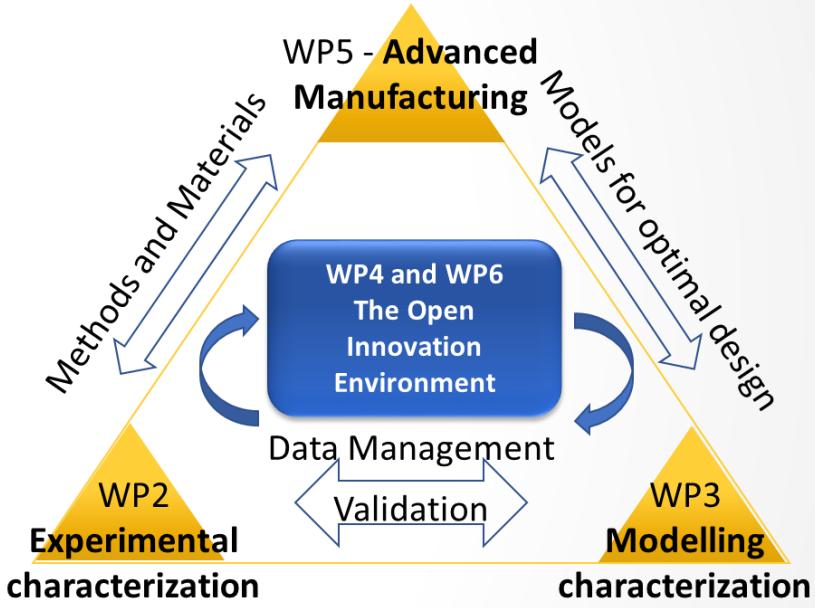
Zhang, P. et al. *Energy* 82 (2015): 1068-1087.

H2020 – OYSTER (WWW.OYSTER-PROJECT.EU)

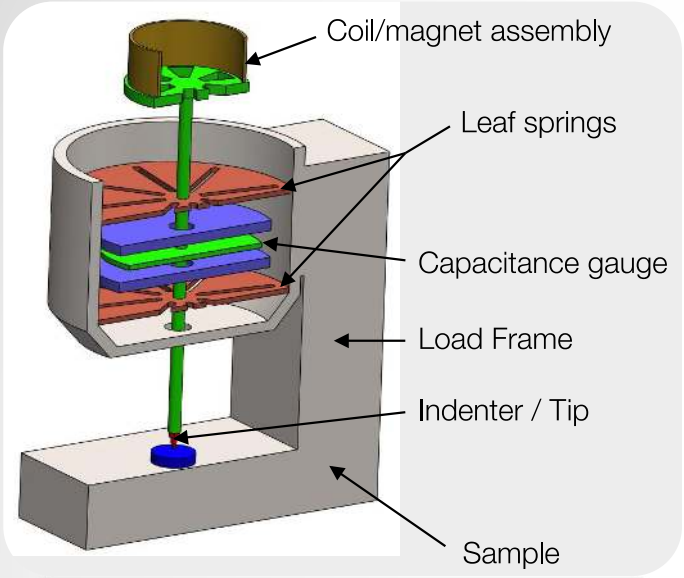
H2020 Oyster Project – G.A. 760827

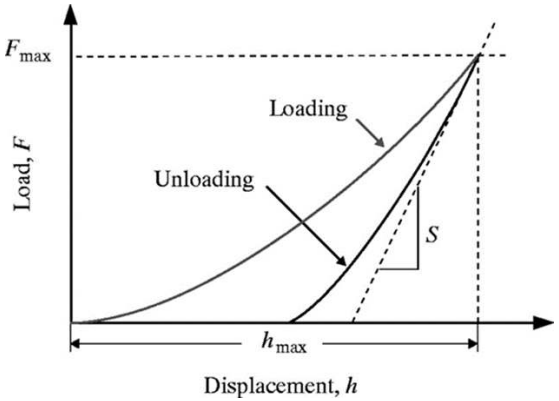




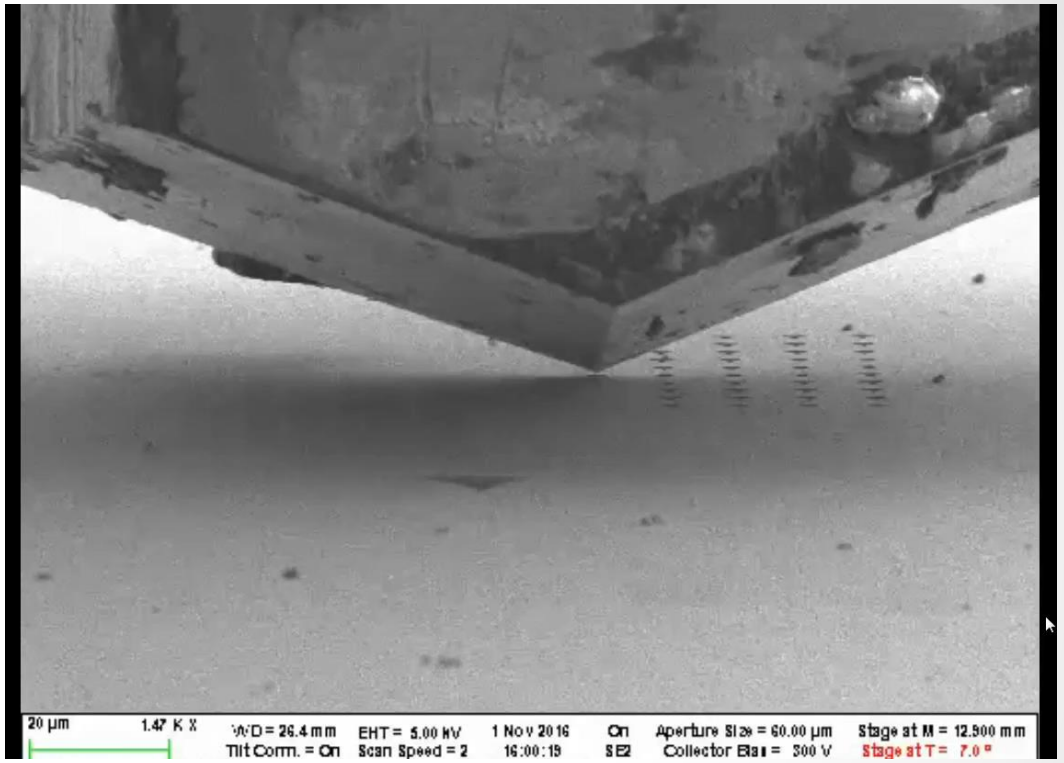


NEXT GENERATION NANOINDENTATION





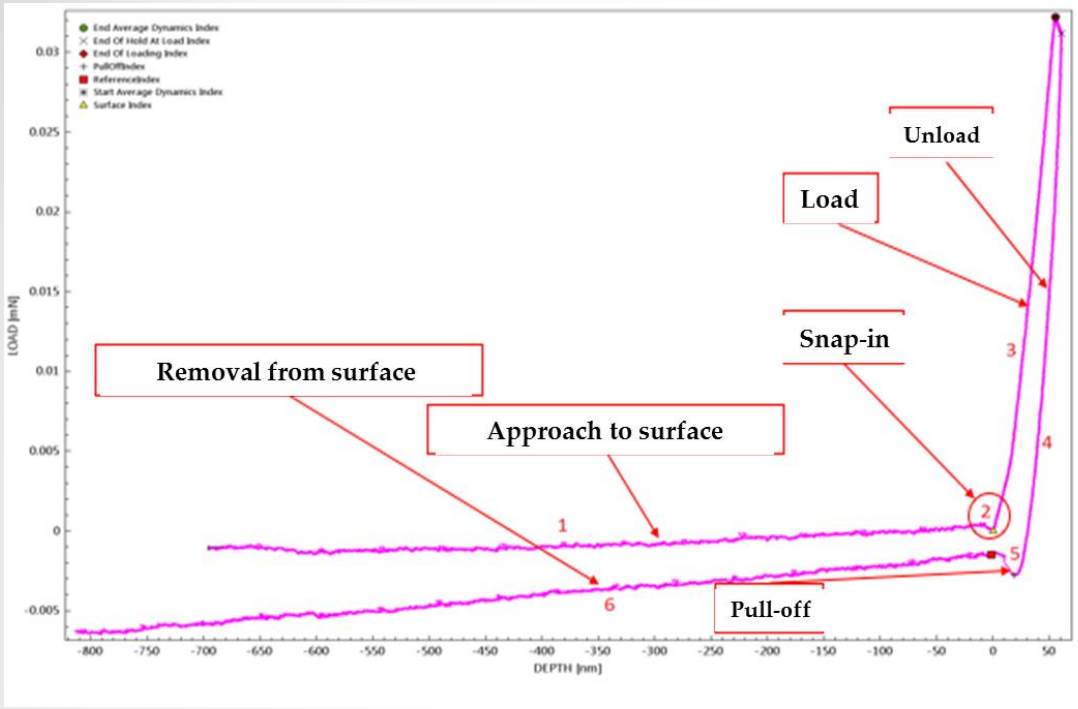
W.C. Oliver, M.G.Pharr, JMR, 1992
ISO 14577



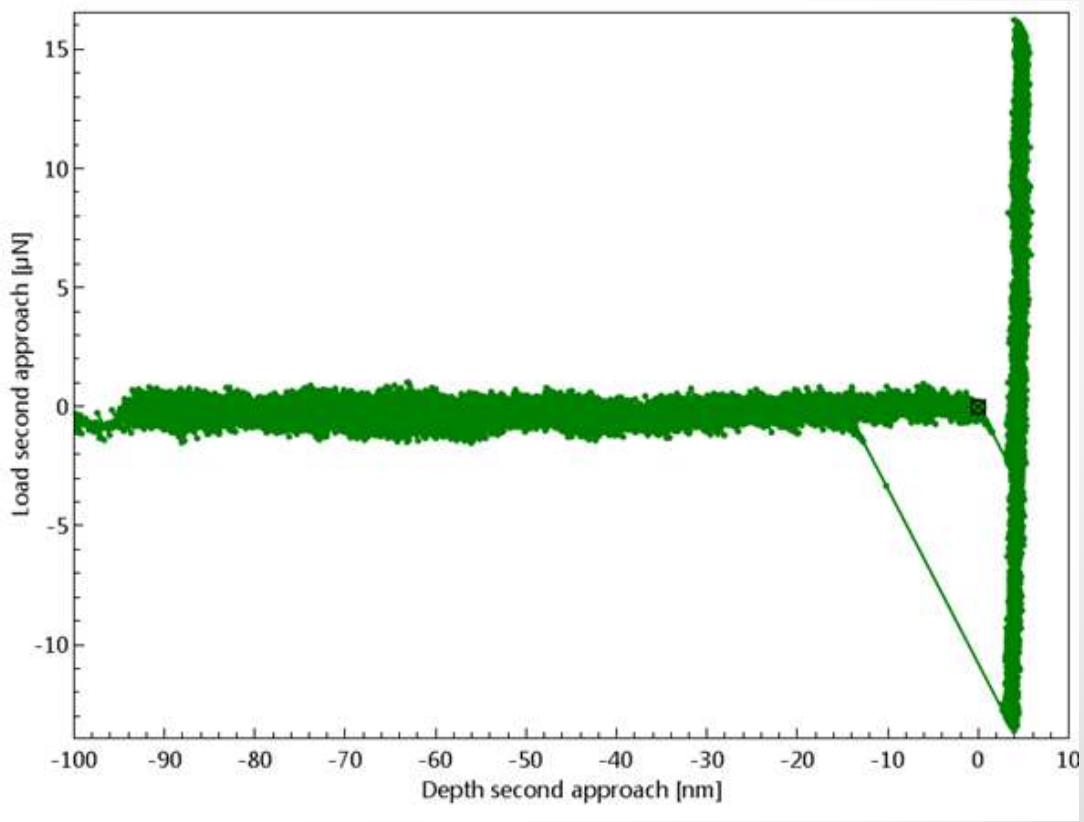
Courtesy of Nanomechanics inc.:

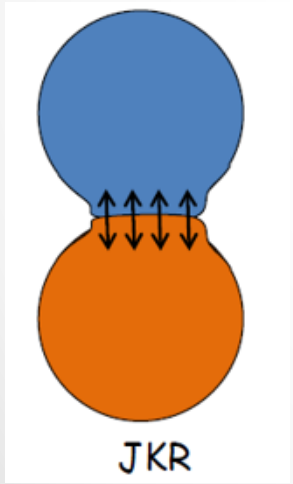
Surface Free Energy by Nanoindentation by High-Frequency (100 kHz) data acquisition nanoindentation experiments.

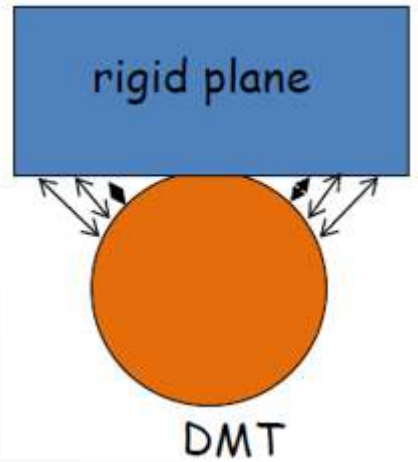
NEXT GENERATION NANOINDENTATION



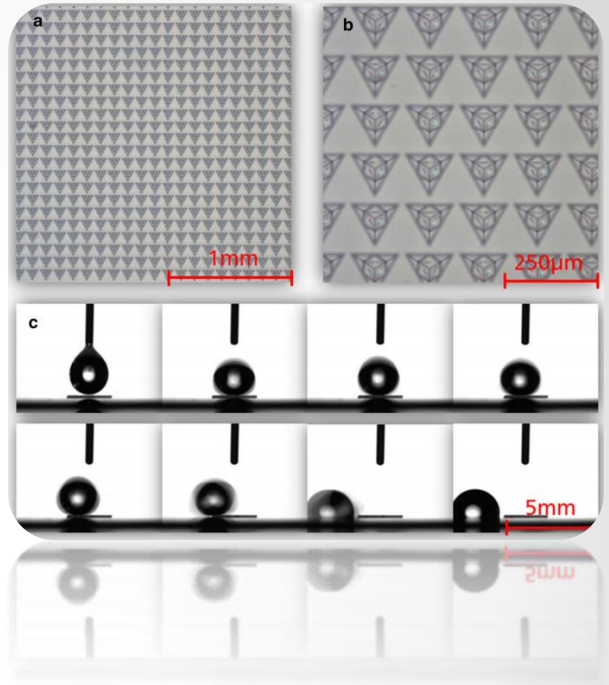
Use of fine calibration procedures and high-speed data acquisition rates to have very accurate measurements of snap-in and pull-off adhesion events

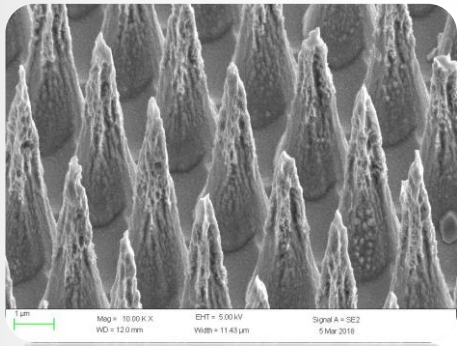




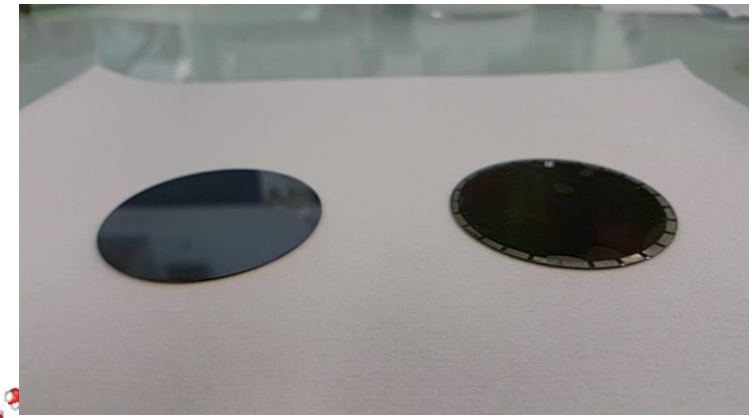


H2020 – OYSTER MATERIALS

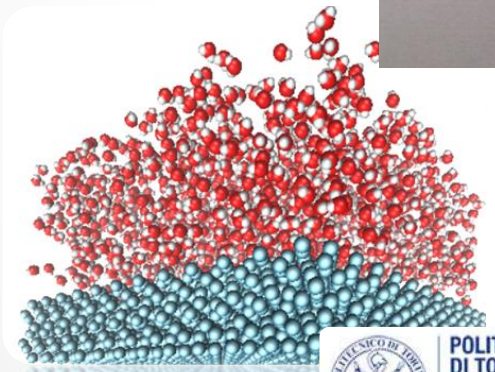




THALES
RESEARCH & TECHNOLOGY

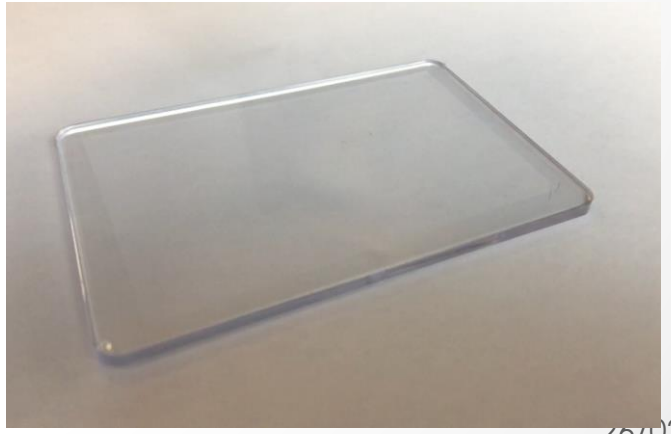


Fraunhofer IWM

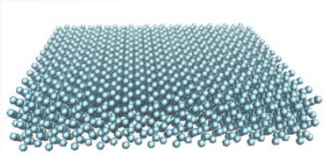


POLITECNICO DI TORINO

FUNCOATS

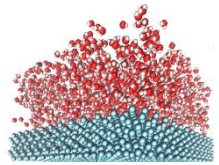


Modelling Architecture (PoliTo – NTUA - Fraunhofer)



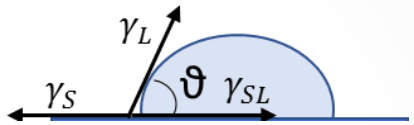
Sample Chemistry

- Bulk material chemistry
- Coating chemistry



Sample Topography

- Ideal/homogeneous flat surface
- Nano-patterned surface
- Micro-patterned surface



Experimental tools

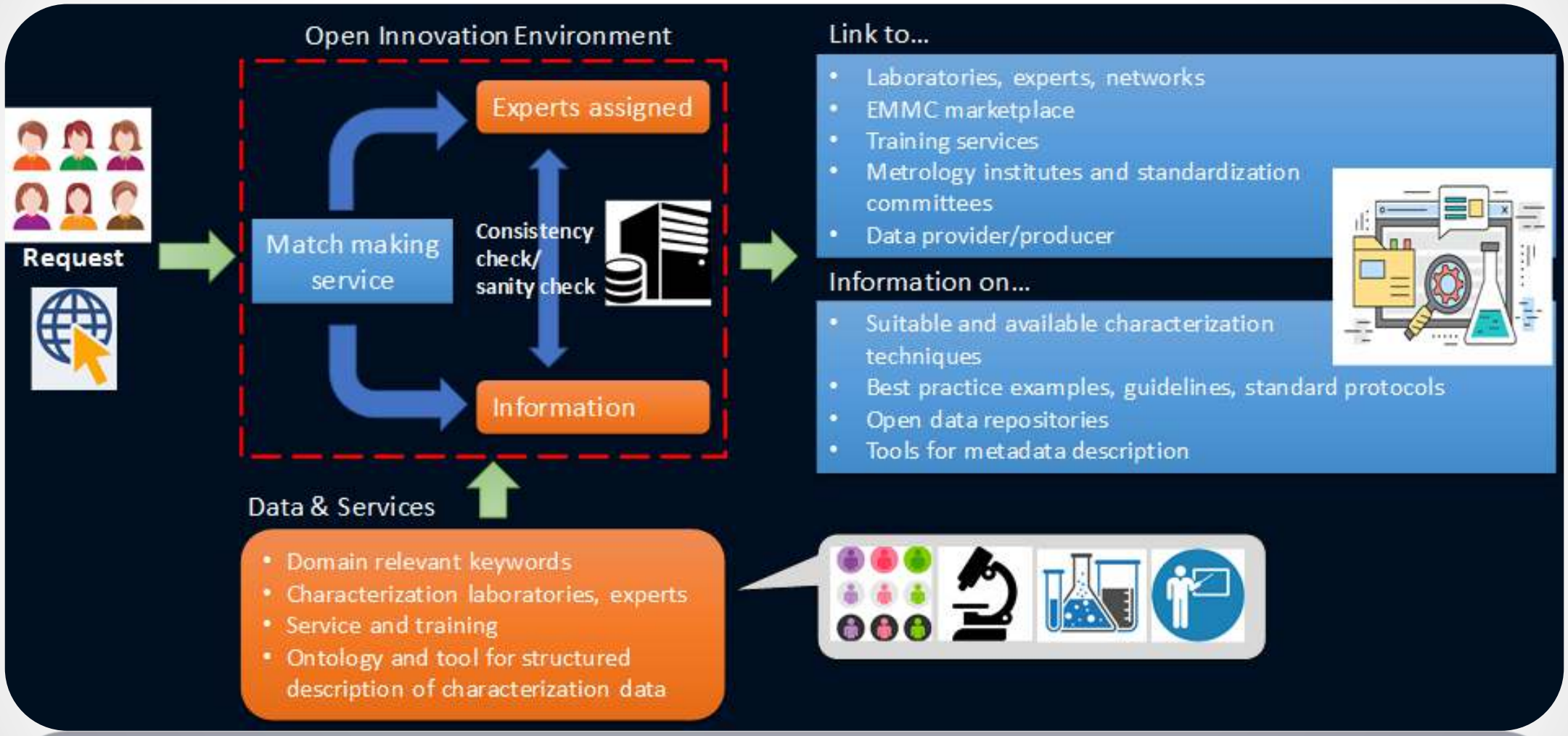
- Patterning technology
- Nano-indentation
- AFM
- Contact Angle

MOdelling DAta MODA-

Study cases:

1. Contact angle measurements of bare and coated (chemically) surfaces
2. Nano-indentation (snap-in) measurements on smooth bare/coated surfaces for surface free energy characterization
3. Nano-indentation measurements on nano/micro patterned surfaces - Loading/unloading curves

The Open Innovation Environment in Oyster



OYSTER and EMCC

MMAMA

CORNET

NMBP-07-2017

OYSTER

EMCC

NMBP-08-2018

FORM PLANET

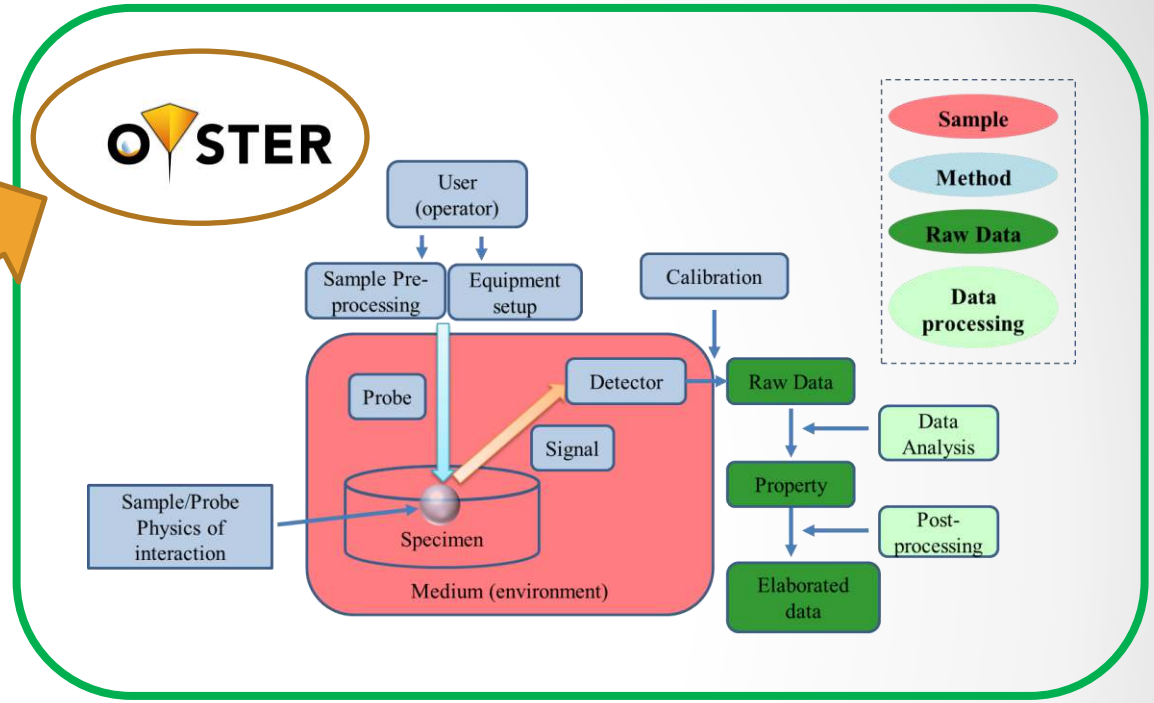
NMBP-25-2017

i-TRIBOMAT
Intelligent Open Test Bed for Materials Tribological Characterisation Services

NMBP-07-2018

TEESMAT
Open Innovation Test Bed for Electrochemical Energy Storage Materials

NMBP-01-2018



- Within the EMCC, OYSTER is currently the main responsible for the initial development of a novel and interoperable METADATA structure for materials characterisation – we called it «CHADA»

A community on Zenodo.org

Initial workflows and docx templates for CHADA have been already developed (see links below).

https://zenodo.org/communities/oyster/

Main Introduction to the CHADA concept and case studies:	https://zenodo.org/record/2636609
CHADA docx detailed forms:	https://zenodo.org/record/2637419
Data Management Plan with CHADA workflow sheet embedded:	https://zenodo.org/record/2636533

CEN Workshop Agreement
OYSTER PROJECT
GA n° 760827

OYSTER

ENTE ITALIANO DI NORMAZIONE

CWA
Materials characterisation - Terminology, classification and metadata

https://www.cencenelec.eu/news/workshops

CONCLUSIONS

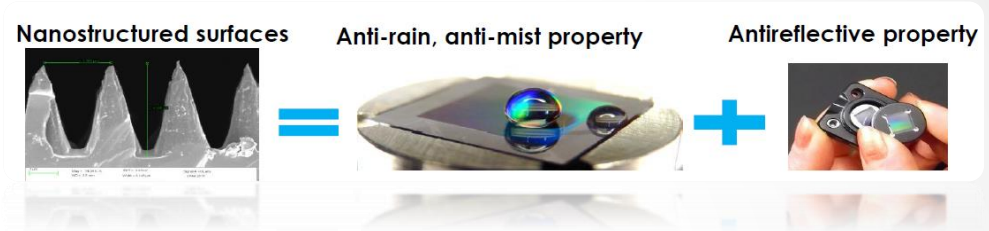
- Nanoindentation and AFM can be used for QUANTITATIVE Surface Free Energy and adhesion measurements on hard super-hydrophobic surfaces;

- The project is working on defining novel metadata structures and ontologies for materials characterization (CHADA), with specific focus – as a case-study – on nanoindentation.

- Next steps in the project will be the full integration between modelling and experiments, as well as the implementation of the ontology for nanoindentation and its integration in Oyster Open Innovation Platform.

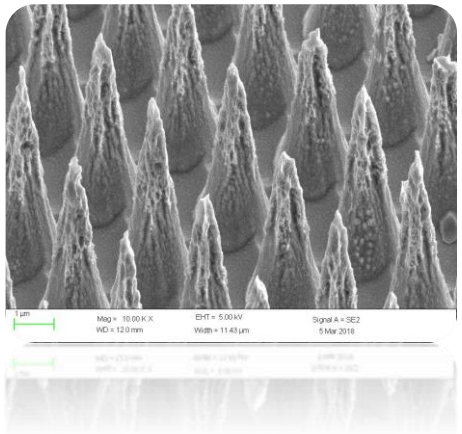
This project has received funding from the European Union's Horizon research and innovation programme under gran agreement No 760827.

THANK YOU!

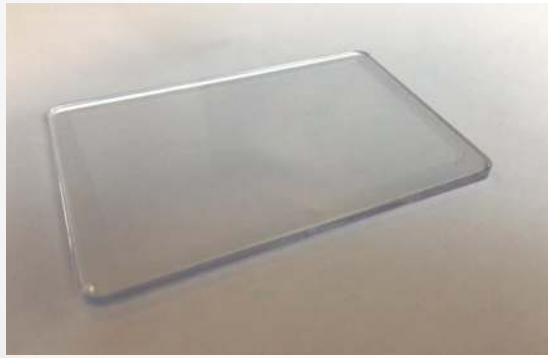


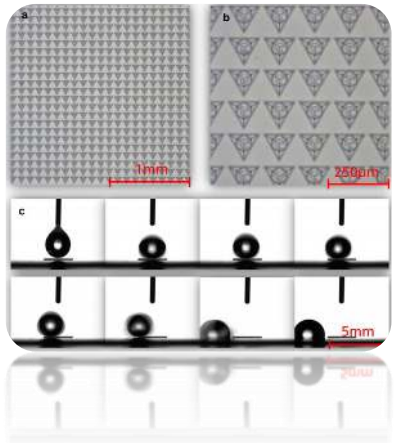
Contact details:

Seba@uniroma3.it



THALES
RESEARCH & TECHNOLOGY





FUNCOATS

Fraunhofer IWM