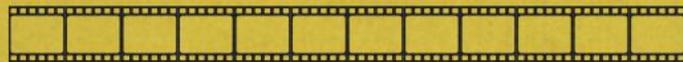


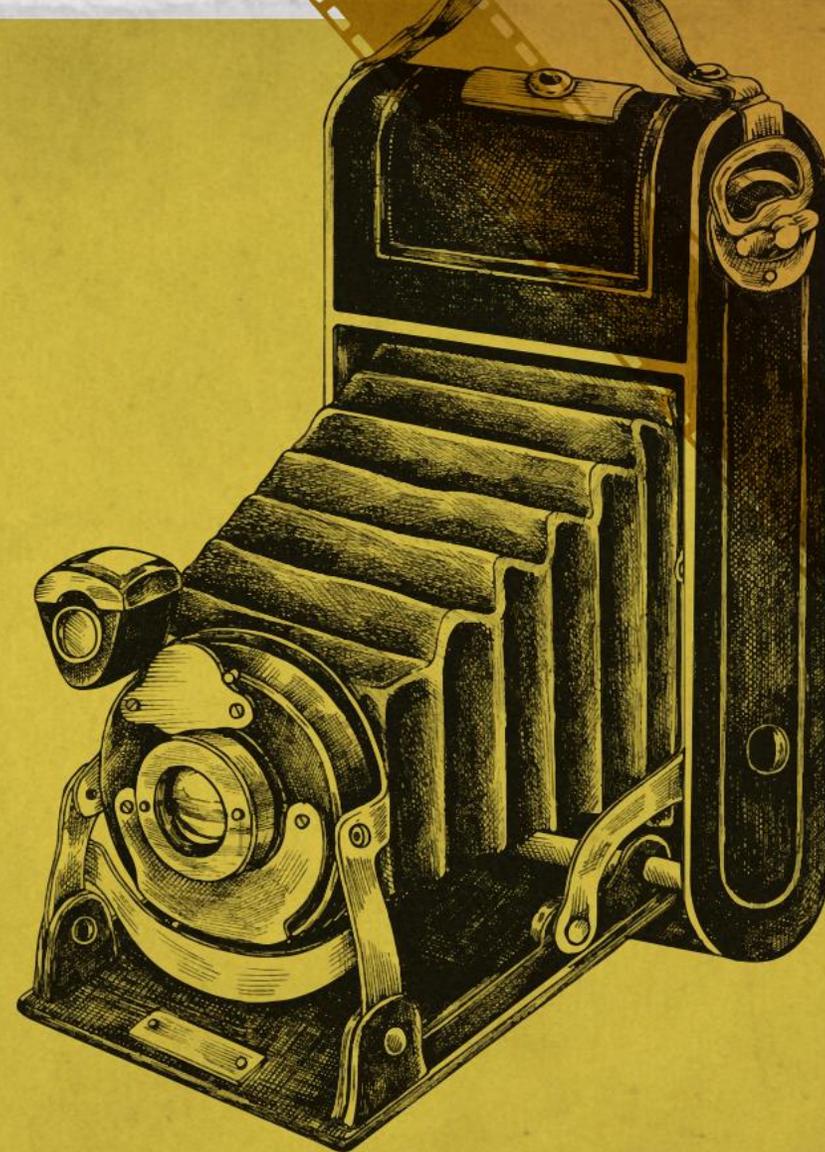
25TH MAY / 2022 ◊ VALENCIA, SPAIN

FINAL WORKSHOP

The NEMOSINE innovative package for cultural heritage preservation



The NEMOSINE project:
from the need to the results



More info at: nemosineproject.eu

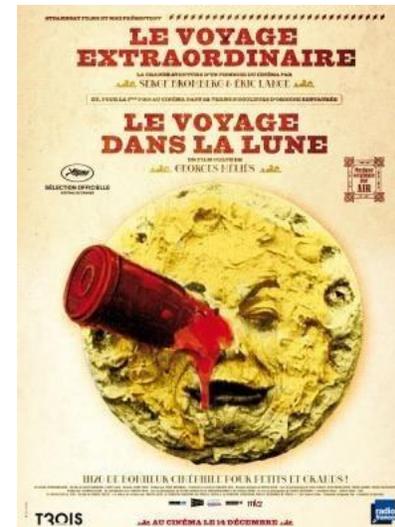


NEMOSINE has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 760801.

The need

► **The facts:**

- **Cinematographic works are an essential component of our cultural heritage and identities and therefore deserve full protection.** In addition to their cultural value, cinematographic works are a source of historical background on the evolution of European society. They provide a comprehensive record of the richness of Europe's cultural identities and the diversity of its people.
- **In order to ensure that European film heritage is passed down intact to future generations, it has to be systematically collected, catalogued, preserved and restored.**



The need

▶ The facts:

- ▶ The worldwide estimation of such holdings within professional film archives is around **18 Mio of film reels on cellulose acetate**, whereof ca. 5% are in a critical stage or showing signs of ***vinegar syndrome***.
- ▶ Conservators consider two approaches when planning treatments to extend the useful lifetime of cultural materials: preventive or or interventive.
- ▶ There have had other technical approaches to solve this real problem that follow the line of replication and copy the original ones in modern digital supports but, they do not give the possibility of a real preservation of the original ones.





NEMOSINE CONCEPT

- ▶ **NEMOSINE** improves the traditional storage solutions, such as freeze storage (below 5°C), by developing an innovative package with the main goal of energy saving and extent conservation time.
- ▶ The **SMART PACKAGE** concept:
 - ▶ All the individual elements will be integrated in a smart package depending on the CH artefact deterioration grade and other requirements for protective or curative purposes.



ACTIVE ACID
ADSORBERS



GAS
DETECTION
SENSORS



MULTI-SCALE
MODELLING

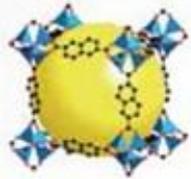


PACKAGING
WITH MODULAR
DESIGN



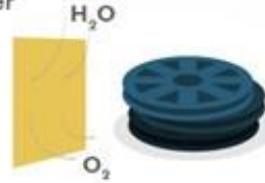
CURATIVE
PACKAGES

NEMOSINE TECHNOLOGIES SUMMARY



WP2 Acetic acid absorbers supported in fractionalized MOFs.

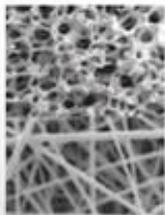
WP6 High barrier package to protect CH against oxygen and Water vapour control.



WP3 Controlled release of active substances to minimize the growing of fungus.



WP1/WP7 Design of a smart package for long time CH (movies, posters, photographs and slides) storage at room temperature.



WP3 High specific surface (opencells foams electrospinning nanofiber) structures containing MOF absorbers and antifungal additives.



WP4/WP5 Sensors based nanotechnology, including electronic wireless devices, for degradation process monitoring. PREDICTIVE MAINTENANCE ACTIONS.

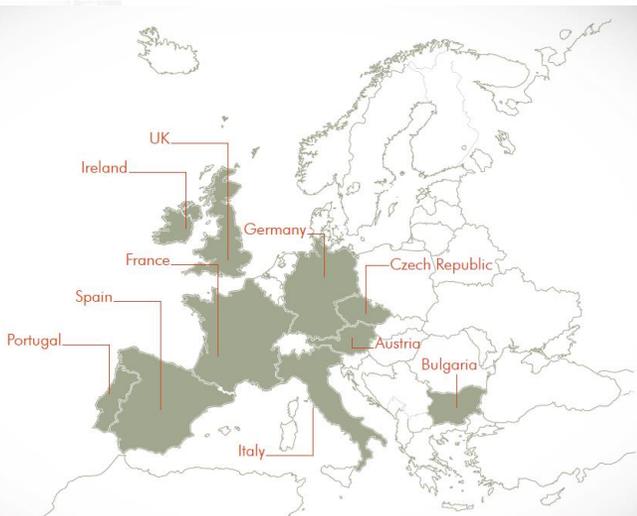
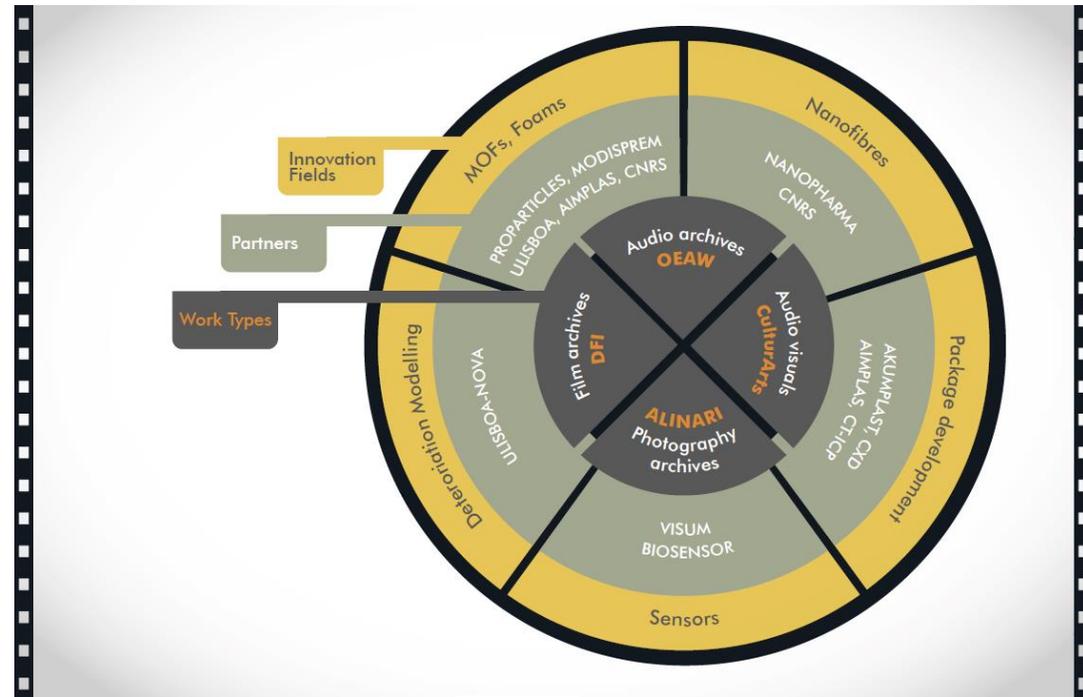


NEMOSINE PARTNERSHIP

▶ The Partnership composition:

- ▶ The presence of main actors in the whole value chain demonstrates the critical mass of complimentary resources that will enable the NEMOSINE project to achieve its targeted societal, industrial, and scientific breakthroughs and commercial success.

- ▶ **RTD partners:** AIMPLAS, CNRS, IST, NOVA, IPC and OEAW
- ▶ **SME partners:** PROM, AKUMPLAST, BIOSENSOR, IRIS, NPH, MODISPREM, PNO, BESKIDPLUS
- ▶ **IND partner:** CXD
- ▶ **SSH institutions:** OEAW, CulturArts, DFF, ALINARI



Technical approach

- LCA
- LCC
- LCSA

Environmental, regulatory & economic analyses

MOF AA Absorber

AA absorber and antifungal integration

- Foams
- Nanofibers
- Cryogels
- Cellulose membranes



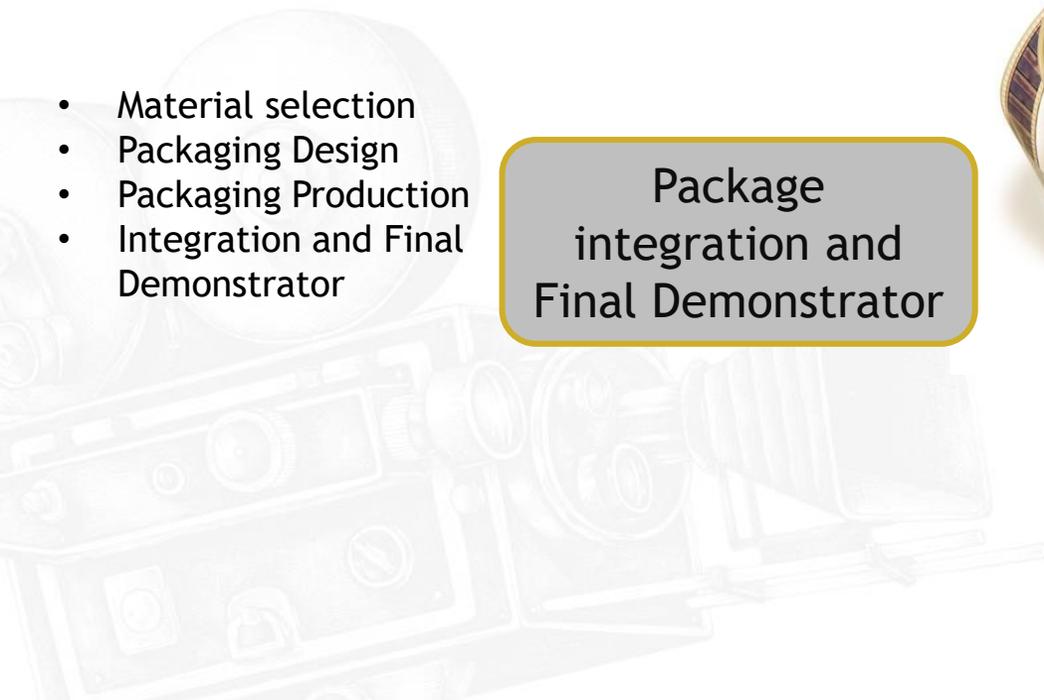
Package integration and Final Demonstrator

Sensors & Wireless control

- NO_x
- AA sensor
- Electronics
- Data communication

Degradation model software

- Data acquisition
- Data management
- Film monitoring





Technical approach

MOF AA
Absorber

AA absorber and
antifungal
integration

Sensors & Wireless
control

Degradation model
software

Package integration
and Final
Demonstrator



Technical approach

MOF AA Absorber

AA absorber and antifungal integration

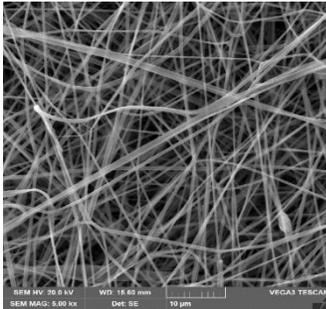
Sensors & Wireless control

Degradation model software

Package integration and Final Demonstrator

AA absorber and antifungal integration technical approach

PVB nanofibers



PU foam



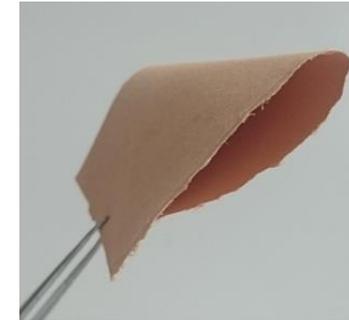
Nanocellulose foams



Impregnated "in situ" PP foam



Cellulose membranes



woven non woven



Foams



Paper



Technical approach

MOF AA Absorber

AA absorber and
antifungal
integration

Sensors & Wireless
control

Degradation model
software

Package integration
and Final
Demonstrator

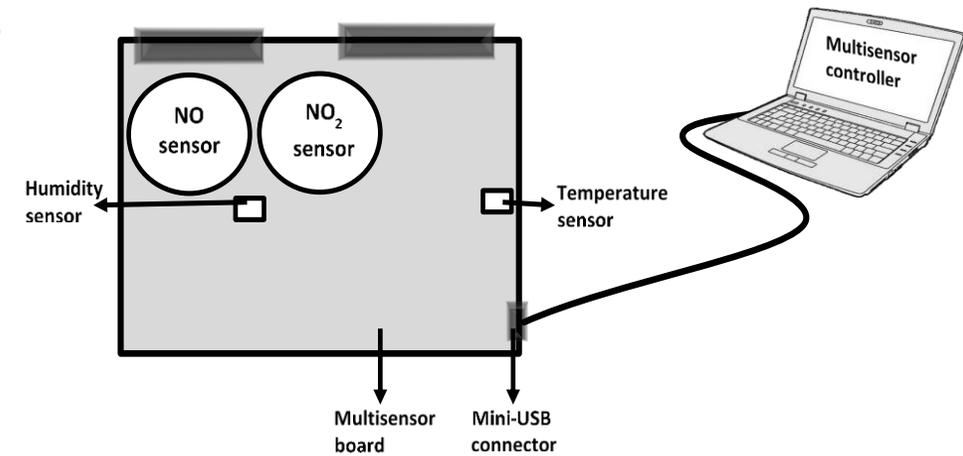
NOx sensor



AA sensor



Wireless Communication





Technical approach

MOF AA Absorber

AA absorber and antifungal integration

Sensors & Wireless control

Degradation model software

Package integration and Final Demonstrator

Monitoring, degradation and control platform

The screenshot displays the NEMOSINE monitoring, degradation and control platform interface. The interface is divided into several panels:

- Left Sidebar:** A list of rooms from ROOM 0102 to ROOM 0109, each with a plus icon and a document icon.
- Top Navigation Bar:** Includes the NEMOSINE logo, 'ROOMS', 'SHELVES', and 'MEDIA' tabs, a '9 ALERTS' indicator, and a user profile icon.
- Main Content Area:**
 - ROOM 0102 Overview:** Shows dimensions (Width 600, Length 1500, Height 350) and a 'MASTER SENSOR' section.
 - SHELVES Grid:** A grid of shelves (010213 to 010219) with film counts and sensor status indicators.
 - CURATOR Profile:** For Ernest Prost, showing archive (010219), film number (135036), status (Poor), and copy number (09).
 - IDENTIFICATION and CONDITION Panel:**
 - IDENTIFICATION:** Title 'Metropolis', ID number 135036, location 010213-032595, type 'Film', specific '35 mm', extent '35 mts', status 'MASTER'.
 - CONDITION:** Condition 'Film&Video', surface 'Rust', image 'Faded', decomp. 'Sticky', shrinkage '75%', last date '2003-07-15'.
 - SENSOR Data Panel:** Shows date record (05/03/2020), NDx (15ppm), ACETIC ACID (0,8 ppm), TEMP (16° Celsius), RH (23%), and classification 'Increasing Degradation'.
 - ROOM 0102 Overview (Right):** A second instance of the room overview panel showing shelves and their status.
 - Graph:** A line graph at the bottom showing environmental data (likely temperature and humidity) over a period of weeks.



Technical approach

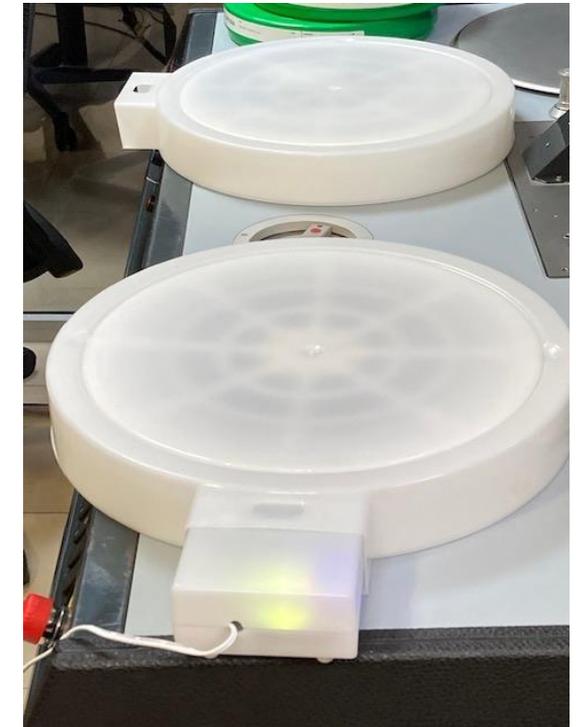
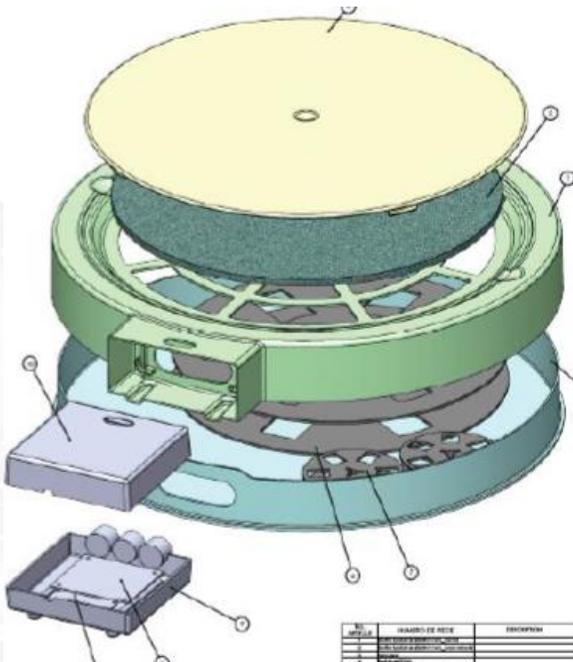
MOF AA Absorber

AA absorber and
antifungal
integration

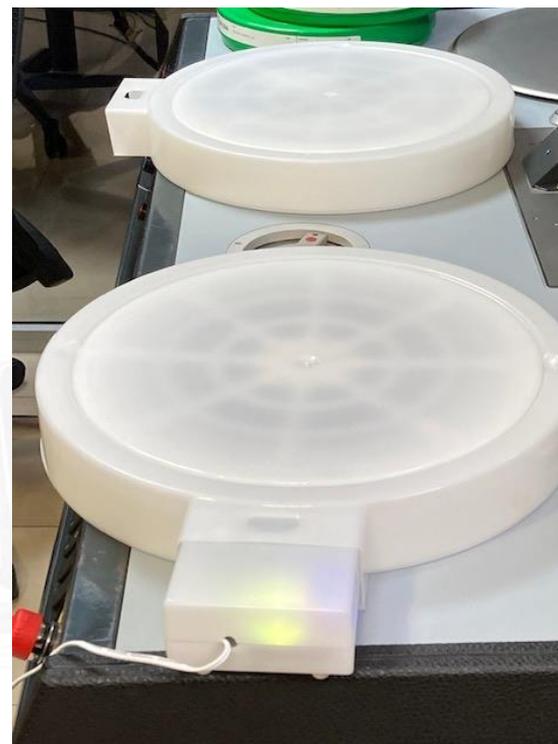
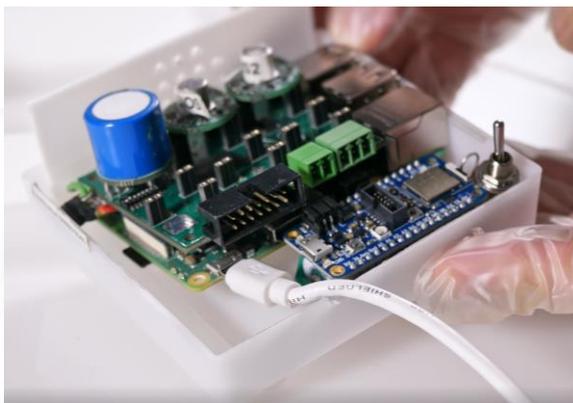
Sensors & Wireless
control

Degradation model
software

Package
integration and
Final
Demonstrator

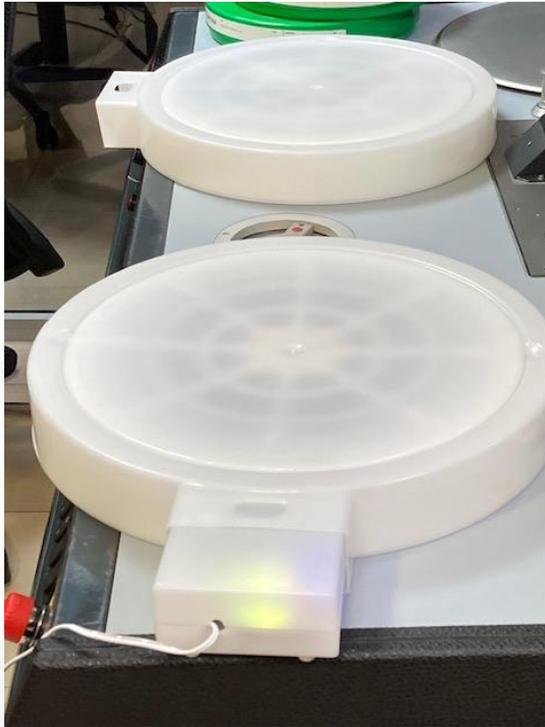


Technical approach



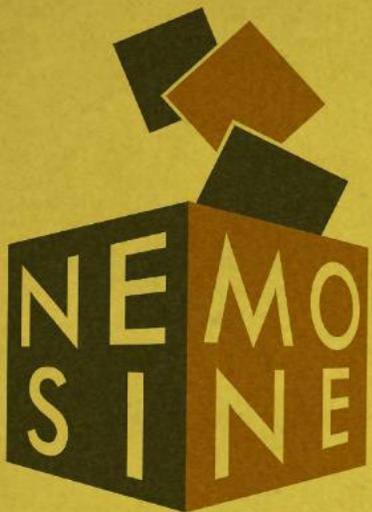
- Sensor conditioning and integration
- MOF instegration
- Model development and data analysis
- Control platform development and validation





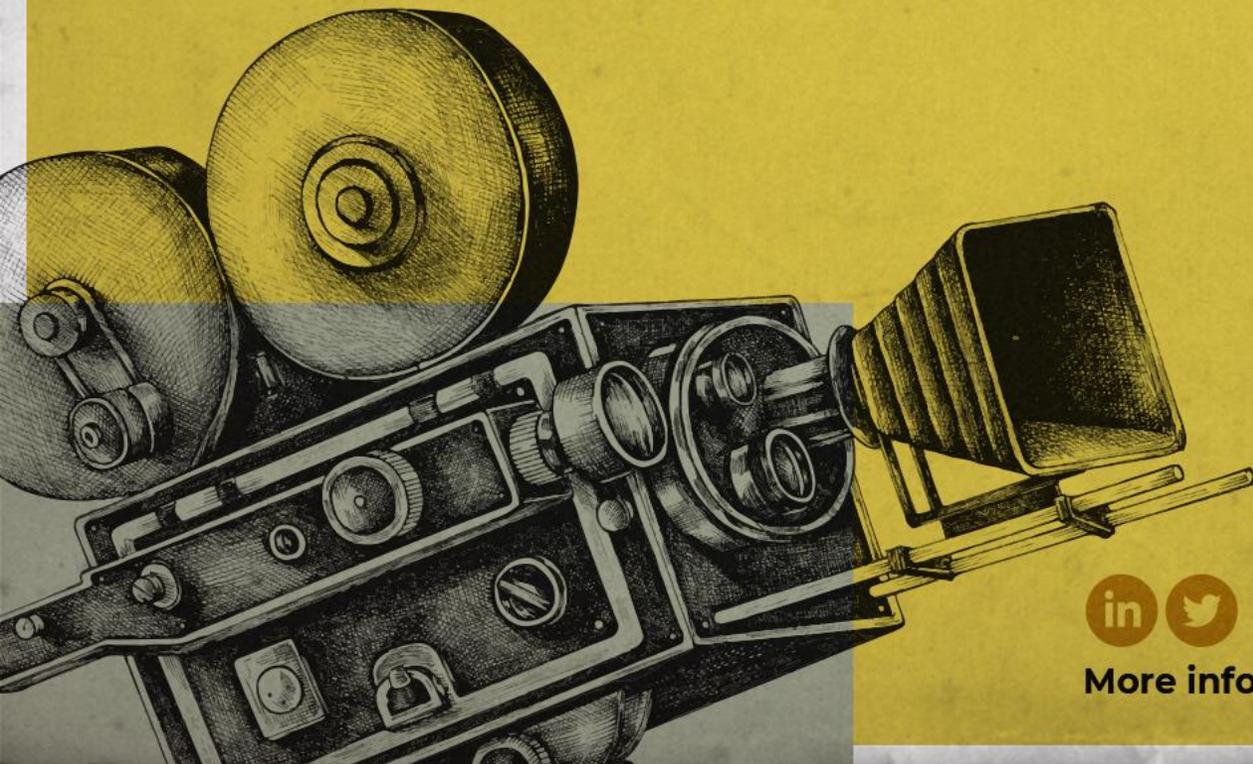
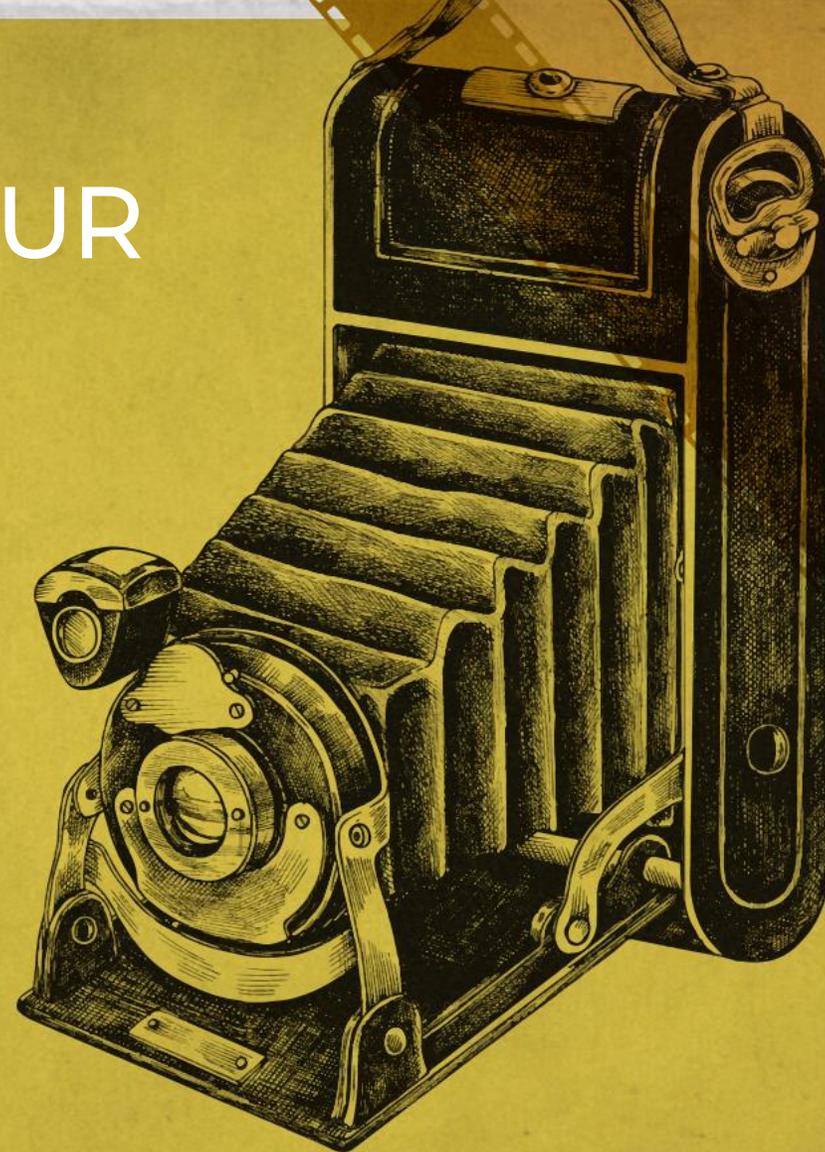
Main results:

- Acetic Acid absorbants based on MOFs:
 - Reduction of de Acetic Acid concentration about 40-50%
- Degradation prediction model
- Acetic Acid sensor to monitorize AA concentration
- Software tool to monitorize the state of the films
- New film box to integrate new functionalities
- To demonstrate how nanotechnology and TIC play a key role for Cultural Heritage preservation



THANKS FOR YOUR ATTENTION

sotero@aimplas.es



More info at: nemosineproject.eu



NEMOSINE has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 760801.