

European Network on New Sensing Technologies for Air Pollution Control and Environmental Sustainability - *EuNetAir*

COST Action TD1105

WGs and MC Meeting at ISTANBUL, 3-5 December 2014

Action Start date: 01/07/2012 - Action End date: 30/06/2016

Year 3: 1 July 2014 - 30 June 2015 (*Ongoing Action*)

ENVIRONMENT AND HEALTH IMPACT OF NANO-MATERIALS FOR CULTURAL HERITAGE



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 **cost**
EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY





NanomeCH Cluster



**Nano and advanced materials for
Cultural Heritage**



www.nanomech.eu

Projects within the cluster

CLUSTER among 5 projects funded by 7th FP

(calls ENV-NMP.2011. 2.2-5 & 3.2.1-1)



www.nanomatch-project.eu

PANNA

www.panna-project.eu



www.nanoforart.eu



HEROMAT
Protection of Cultural Heritage Objects
with Multifunctional Advanced Materials

www.heromat.com

imat

www.imatproject.eu

Proposal of 5 working groups (WG)

Topics addressed:

- ✓ **Nanofunctional materials for cleaning, consolidation and protection.**
 - ✓ **Study of material degradation properties.**
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- ✓ **Development of new restoration and application techniques for compatible and durable preservation, and study of their effect on the performance of materials.**
 - ✓ **Study of methods and techniques for monitoring and assessment of efficiency in laboratory and on site in real time scale.**

Proposal of 5 working groups (WG)

- ✓ **Applicability assessment.**
- ✓ **Study of durability of applied materials (short and long-term effects on mineral historical substrates), study of long-term behavior.**
- ✓ **Establishment-adjustment-development of methods for characterization of functional and other important properties of unprotected and protected targeted historical materials.**
- ✓ **Common studies on the assessment of the environmental and health impact of the new materials and technologies and analysis of factors that would influence their use.**
- ✓ **Life cycle assessment of environmental friendly advanced protective materials.**

Final structure

CLUSTER COORDINATORS: A. Bernardi (a.bernardi@isac.cnr.it), J. Ranogajec (janjar@uns.ac.rs)

WG1 - NANO AND ADVANCED MATERIALS AND THEIR APPLICATIONS

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WG5 - ENVIRONMENT AND HEALTH IMPACT

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WG4 - PERFORMANCE ASSESSMENT

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WG2 - INNOVATIVE TECHNOLOGIES AND TOOLS

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WG3 - TECHNOLOGY TRANSFER AND MARKET OPPORTUNITY

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WG6 - OPPORTUNITIES FOR SMES

L. Pockelé (NANOMATCH)
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Cluster meetings

- **1st Exploratory Meeting: EUROMED 2012 - Limassol, Cyprus - 30th October 2012**
- **2nd Meeting: HEROMAT Workshop - Perugia, Italy - 9th May 2013**
- **Clustering workshop: Bruxelles, Belgium - 21st June 2013**



NANO AND ADVANCED MATERIALS FOR CULTURAL HERITAGE

June 21st 2013
MADOU Auditorium

Metro station "Madou", Place Madou 1, 1210 Brussels



- **3rd Meeting: Bruxelles, Belgium - 22nd June 2013**
- **4th Meeting: Florence, Italy - 13th November 2013**
- **5th Meeting: Novi Sad, Serbia, 8th July 2014**

Ways to collaborate



- ✓ Organise **common training courses**
- ✓ Organise **common teaching activities**
- ✓ Develop and publish **common guidelines**
- ✓ **Dissemination activities** for increased impact, e.g. participation on fairs with common stands and in international conferences and workshops
- ✓ **Joint Press Releases**
- ✓ **Joint scientific publications** in international journals dealing with conservation to address the wide audience of conservators
- ✓ Possible **future cooperation between the partnership of the cluster inside Horizon 2020** regarding exploitation of project results

Example of activity

EWCHP-2013

EWCHP-2013
3rd European Workshop
on Cultural Heritage Preservation
Bozen / Bolzano, Italy, September 16 to 18, 2013

www.3encult.eu/en/ewchp



AFTERNOON SESSION 13:00 to 16:25

NanoMaterials for cultural heritage (NanomeCH cluster)

Cluster NanomeCH: Introduction to NanomeCH Cluster

Coordinator: Adriana Bernardi (15 min.)

The organization, focus and activities of "NanomeCH CLUSTER" will be presented.

Working Group 2 NanomeCH: INNOVATIVE TECHNOLOGIES AND TOOLS

EU project NANOMATCH - Alkaline-earth metal alkoxides innovative conservation materials for stone and wood: syntheses and properties of the alkaline-earth metal alkoxides

Monica Favaro and Matteo Chiurato (30 min.)

Metal alkoxides belong to a well known class of chemicals sensitive to atmospheric conditions and moisture. Their decomposition products give different forms of carbonates, that in the case of Ca/Mg derivatives can be used as consolidants for carbonatic stones and that can also be employed as alkaline reserve in wood. Metal alkoxides history, some structures, their chemical-physical properties, their reactivity, their behavior and different synthetic pathways to obtain these species will be presented. The characteristic of the coating of some metal alkoxides are investigated; particularly attention will be reserved to the parameters (solvent, temperature, H.R., ...) that can drive the carbonation process to different forms of carbonates and the behavior of these reactions and coatings will be described.

EU project NANOMATCH - Application of calcium alkoxides as conservative materials on stone and wood. Preliminary results and perspectives

Martin Labouré (30 min.)

Application methodologies of Innovative metal alkoxides for treatment of different kind of stones and wood species have been tested and most suitable ones selected for the treatment of those materials. A scientific campaign is currently on-going to assess their performance as conservative products. Results on the performance assessment of solutions and sols of metal alkoxides will be presented together with examples of first application on different European historical sites.

EU project NANOFORART - Innovative nanostructured systems for cleaning, consolidation, and deacidification of movable and immovable artworks

Rodorigo Giorgi (30 min.)

In the context of the NANOFORART project (Nano-materials for the conservation and preservation of movable and immovable artworks), new nano-materials and responsive systems have been developed and experimented for the preservation of works of art. The main challenge is the combination of functional materials arising from the recent developments in nano-science with innovative techniques in the restoration of works of art. The

research activity has been focused on the development of manageable methodologies, based on nanosized structures and with a low environmental impact. The main results include the production of dispersions of nanoparticles (hydroxides) for consolidation of wall paintings and limestones, and deacidification of paper and canvas, and the formulation of cleaning systems based on micellar solutions, microemulsions and gels. These systems offer new reliable pathways to restore works of art by combining the main features of soft and hard-matter systems for cultural heritage conservation. Conventional materials, in fact, often lack the necessary compatibility with the original artworks and a durable performance in responding to the changes of natural environment and man-made activities.

Working Group 5 NanomeCH: - ENVIRONMENT AND HEALTH IMPACT

EU project NANOMATCH - on site measurements of climatic parameters

Francesca Becherini (20 min.)

The efficiency of the innovative metal alkoxides is being evaluated in 4 different European historical sites characterized by different climate. Substrate models and real surfaces treated with the metal alkoxides have been exposed on the field and the main climatic/microclimatic parameters are being collected nearby the exposure locations in order to study the effect of the environment on the performance of the treatments. The methodology followed for the field exposure tests will be described and the preliminary results presented. At the same time, the impact of the use of metal alkoxides in sols and solutions on human health and environment, including the eventual release of nano-particles after application will be assessed through laboratory tests. Applications guidelines for the use of the newly developed nanostructured materials will be provided at the end of the project

Working Group 3 NanomeCH: TECHNOLOGY TRANSFER AND MARKET OPPORTUNITY

EU project PANNA: Atmospheric pressure plasma for the cleaning of CH assets and deposition of protective coatings

Alessandro Patelli (30 min.)

Plasma is a ionized gas full of reactive species able to reduce or oxydise deterioration products on CH surfaces. Basics of plasma together with possible applications of this novel technique in the field of conservation will be addressed.

"EU project PANNA Cleaning trials with commercial plasma torches on different deteriorated surfaces. Preliminary results and perspectives

Stefano Voltolina (30 min.)

Advantages and drawbacks of different commercially available plasma devices, used on different stone, metal and wall painting substrates, for the removal of polymers, graffiti, organic and inorganic dirt will be presented.

Working Group 6 NanomeCH: OPPORTUNITIES FOR SMES

EU project NANOMATCH, NANOforART and PANNA-Opportunities for SMES

Luc Pockelé (20 min.)

The projects NANOMATCH, NANOforART and PANNA enjoy a large presence of SME's in their consortium. Participating in such projects as SME's provide the occasion to contribute to and to acquire knowledge and expertise on the latest technologies under development. At the same time, opportunities for subsequent exploitation of this knowledge and expertise are present in each of the areas of activity of the participating SME's. e.g. manufacturing, distributing and using the nanomaterials being developed in NANOMATCH and NANOforART and of the plasma-torch and its applications being developed in PANNA.

Target: Conservation scientists, Conservators, policy makers in CH, producers and sellers of products for CH, material scientists and environment physicists

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Materials & technologies for improved Indoor Air Quality

**ECTP conference
Brussels, 19th June 2014**

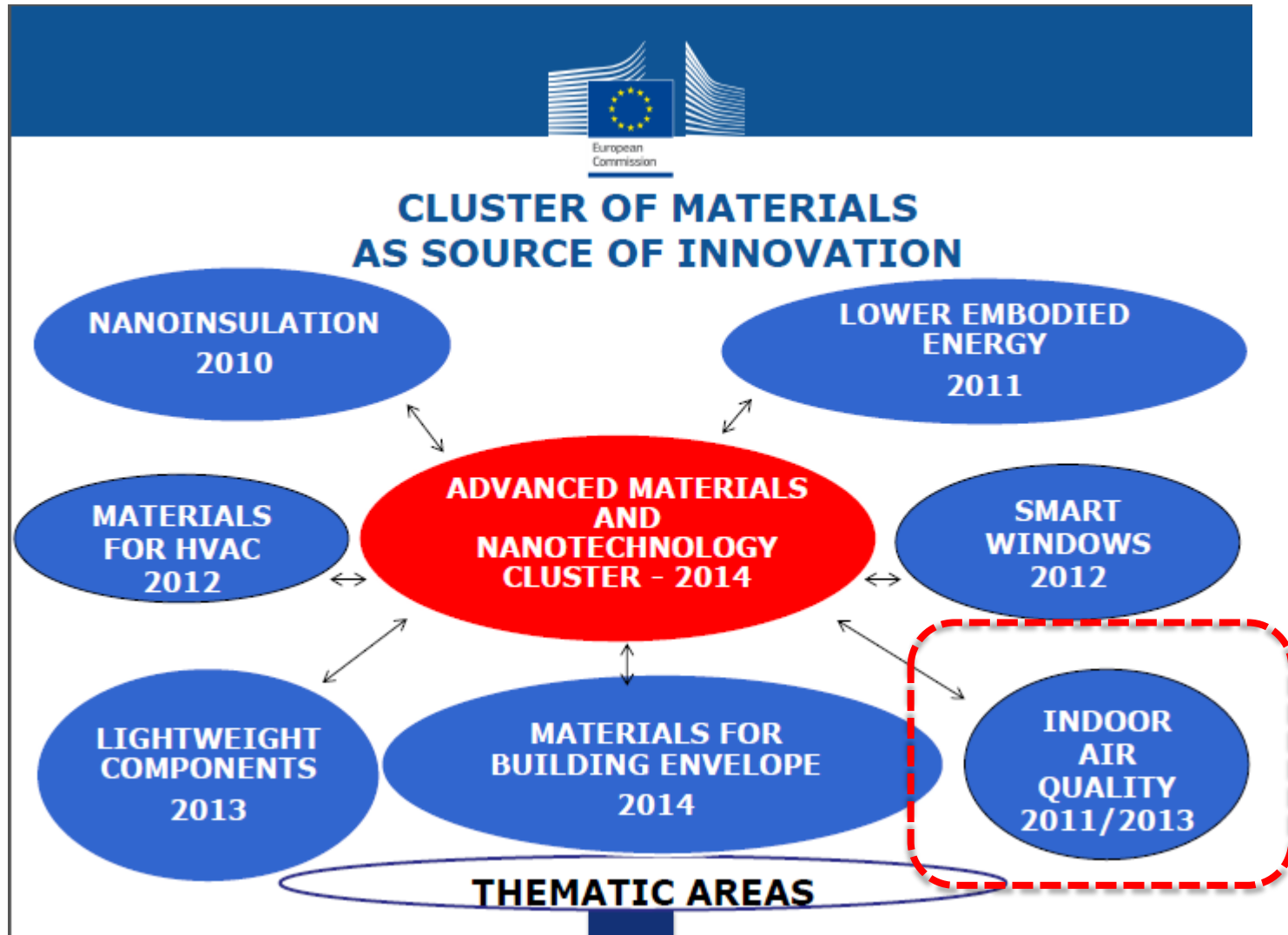
**Dr Monique Lévy
European Commission**

DG RTD

Directorate D

"Key Enabling Technologies"

Other EU clusters



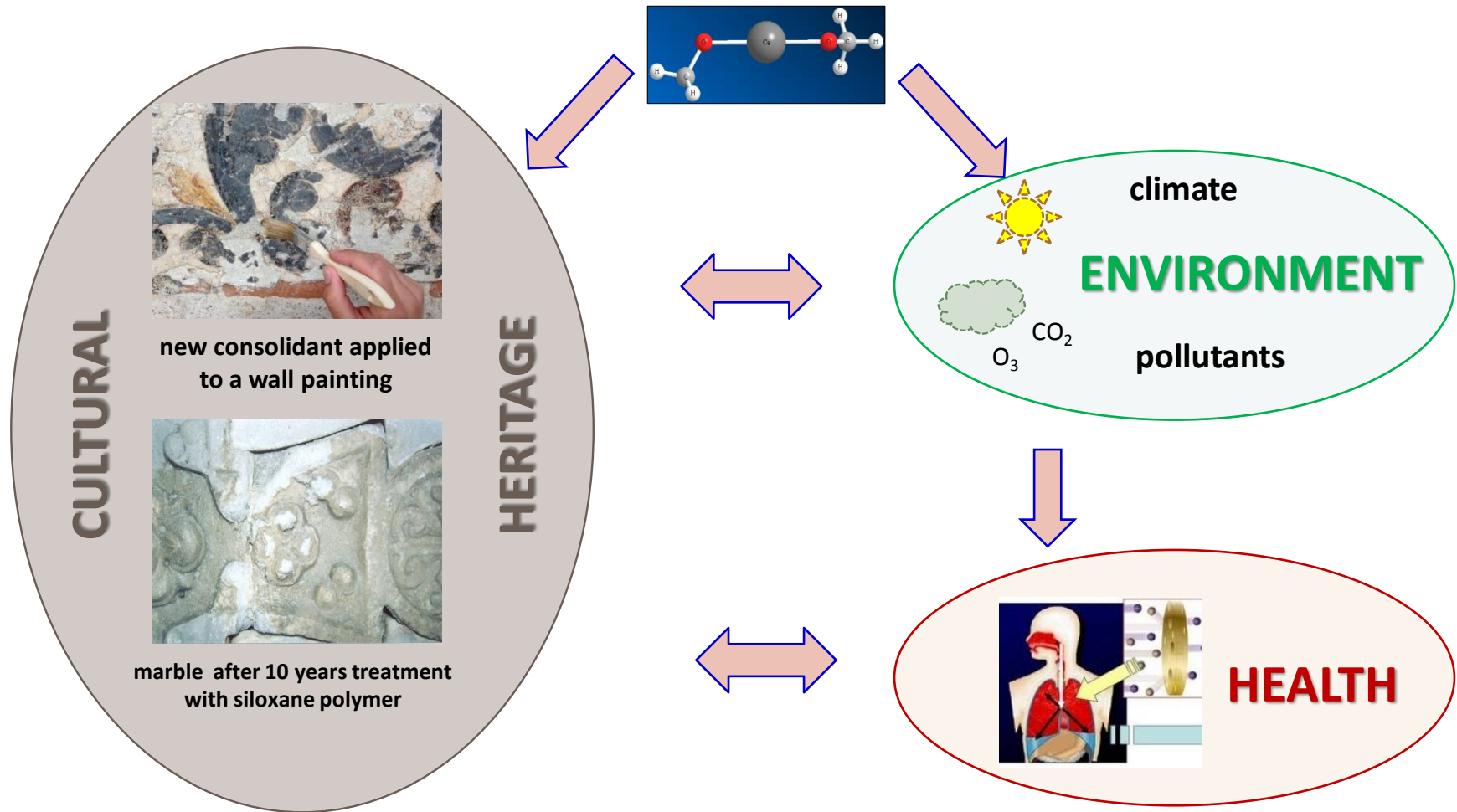


Further research needed in materials for improved Indoor Air Quality

Sources:

- Regular contacts with stakeholders
- Roadmap on Materials for Construction presently under preparation, to be issued in 2015
- Questionnaire in July – September 2014 to identify research needs in Materials for Construction
- Feedback from research projects and from clustering
- Investigate interest on Indoor Air Quality research outside building applications

WG5 “Environment and Health Impact”

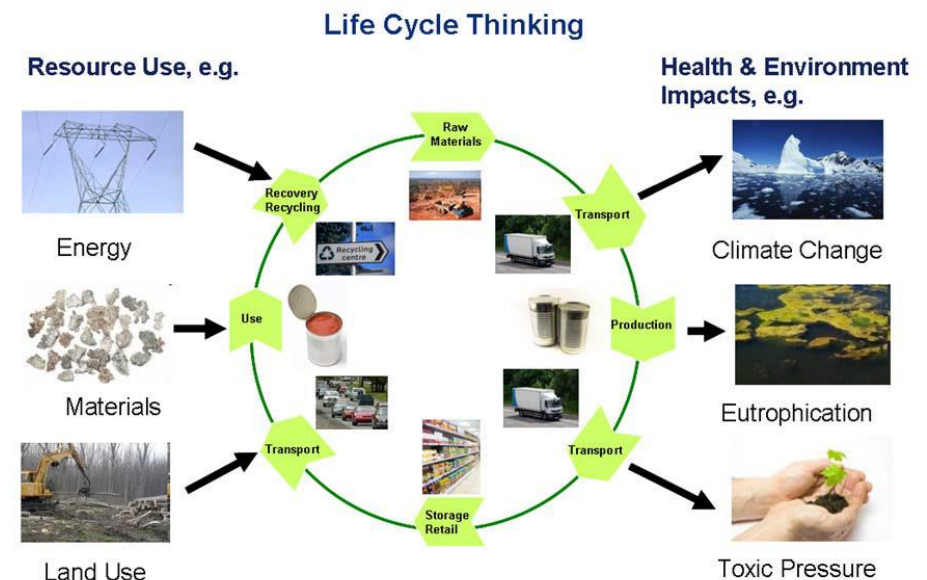


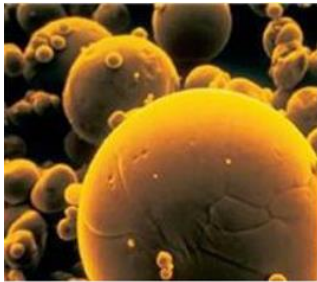
Impact on Environment

LCA analysis (EN ISO 14040):

- ✓ tool for evaluation of impacts of products on environment
- ✓ base for development of Environmental Product Declaration (EPD), a standardized tool to communicate the environmental performance of a product or system
- Lack of such surveys on the field of conservation of cultural heritage
- Rare EPDs exist for conservation and restoration products

To apply Environmental Life Cycle Assessment (LCA) analysis to the newly developed advanced materials for protection, conservation and restoration of cultural heritage objects.

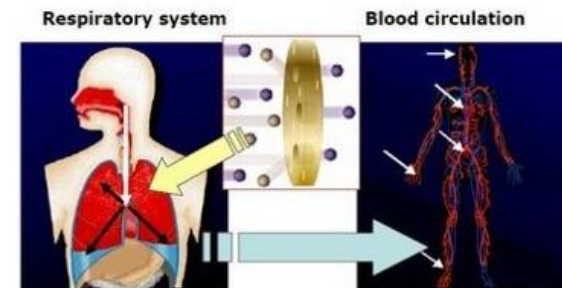




Use of nanomaterials in research or production processes → risk of **exposure to nanoparticles** through **inhalation, dermal contact** or **ingestion** depending on use and handling

Health risks associated with manufacturing and using nanomaterials **not yet clearly understood** → minimal information on dominant exposure routes, potential exposure levels and toxicity

Scientific studies → some nanomaterials are **biologically active** and can penetrate through the skin or move from the respiratory system to other organs



On going research on the potential health effect of exposure to nanomaterials and workplace exposure control methods

It needs:

- ✓ To demonstrate the reduced impact of the newly developed materials in terms of hazardous chemicals and nanoparticles exposure
- ✓ To assess their impact on the environment and human health
- ✓ To promote and assure the safe use of engineered nanomaterials and their technological applications
- ✓ To ensure that the investment into the development of nanotechnologies result in long-term benefits and sustainable, smart and healthy products which meet the targets of human well-being and safety, eco-compatibility and respect of the environment



www.nanomech.eu



***Thank you
for your kind attention***

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