UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

CORSO DI DOTTORATO IN INEGNERIA DEI PRODOTTI E DEI PROCESSI INDUSTRIALI
Ciclo 32°

Proposta di progetto di dottorato

Il sottoscritto Prof./Dott. __ Giuseppina _____Luciani____

Nome *Cognome*

Professore IF ☐ Professore IIF ☒Ricercatore ☐ Ricercatore a tempo determinato ☐

afferente al Dipartimento di Ingegneria Chimica, dei Materiali e della Produzione Industriale

chiede di essere inserito nell'elenco dei tutors per il 32° ciclo.

Tematica di ricerca proposta:

Formulazioni bioispirate ed ecocompatibili contro l'invecchiamento precoce
Bioinspired eco-sustainable formulations for healthy aging

Curriculum di riferimento:

☒Ingegneria dei Materiali e delle Strutture

☐Ingegneria Chimica

☐Tecnologie e Sistemi di Produzione

N° di dottorandi con borse ministeriali dei quali il proponente è stato tutor nell'ultimo triennio
0

Curriculum del proponente (Max 500 parole. Indicazione di pubblicazioni, brevetti, responsabilità di o coinvolgimento in progetti di ricerca, esperienze scientifiche) con riferimento alla tematica proposta

Giuseppina Luciani, PhD

Education

Born in 1973, Giuseppina Luciani graduated in Chemical Engineering cum Laude at the University of Naples Federico II in 1996. She received her PhD in Materials Engineering in 2001 from the same University, with a thesis on "Phase transitions in inorganic amorphous systems".

Career

Associate Professor of Chemistry since October 2015. She is part of the "Department of Chemical, Materials and Production Engineering" of the University of Naples Federico II. She is also member of the "Interdisciplinary Research Centre on Biomaterials" of the University of Naples Federico II. In 2002 she was made assistant professor of Chemistry at the same university.

Scientific activity

Until June 2016 she appears as author in more than 50 publications in international high quality peer reviewed journals, receiving more than 200 citations, with an h index of 10 (Scopus).

Her research work has been focused on the design, synthesis and characterization of glasses, ceramics, glass-ceramics and nanostructured organo/inorganic hybrids, through wet chemistry routes. She is highly skilled in both synthesis and functionalization of ceramic nanostructures through sol-gel as well as hydrothermal processes. Mild synthesis conditions and accurate design of process parameters have been exploited to produce ceramic as well as hybrid nanostructures, tuning size, shape, and surface chemistry in order to obtain bioactive hybrids and nanocomposites, multifunctional coatings, smart drug delivery carriers, photoconductive TiO2 based systems.She isappointed reviewer for international journals on chemistry of materials.

Prizes and Awards

2001 CCT PRIZE, 7th Ceramic, Cells and Tissue "Biomimetic Engineering: a New Role of Ceramics".

Commitments

Since 2013 she is member of the management committee for Cost Action MP1206 - Electrospun nano-fibres for bio inspired composite materials and innovative industrial applications.

2002-2012: Member of the commission of the PhD program "Ingegneria dei Materiali e delle Strutture"at University of Naples Federico II

Funded Competitive Projects

2000 -2001: PROGETTO GIOVANI RICERCATORI- "Hydroxyapatite deposition on bioactive glass and polymeric substrates from simulated body fluids under dynamic conditions".

Relevant Publications to the project

1.G. Vitiello, A. Pezzella, V. Calcagno, B. Silvestri, L. Raiola, G. D'Errico, A. Costantini, F. Branda, G. Luciani, Giuseppina, J. Phys. Chem C., 2016, 120, 6262−6268.

2. G. Vitiello, A. Pezzella, A. Zanfardino, M. Varcamonti, B. Silvestri, A. Costantini, F. Branda, G. Luciani, Titania as driving agent for DHICA polymerization: a novel strategy for the design of bioinspired antimicrobial nanomaterials, J. Mater Chem B, 3 (14), 2015, 2808-2815.

3. A. Pezzella, L. Capelli, A. Costantini, G. Luciani, F. Tescione, B. Silvestri, G. Vitiello, F. Branda, Towards the development of a novel bioinspired functional material: Synthesis and characterization of hybrid TiO2/DHICA-melanin nanoparticles, Mater.Sci.Eng. C 33 (1), 2013, 347-355.

Sintesi del Progetto di Ricerca(Max 500 parole. Stato dell'arte, breve programma previsto per le attività e obiettivi)

Abnormal production of free radicals and reactive oxygen species (ROS) under oxidative stress conditions is the major biochemical trigger of premature aging of cells underlying severe and disabling pathological conditions, such as cardiovascular disease, neurodegenerative disorders and cancer.
Eumelanins, negatively charged, hydrophobic natural pigments derived from tyrosine are endowed with antioxidant properties, linked to their polyhydroxyindolyc nature, therefore they can act as radical scavengers and play a buffering effect towards ROS [1].
On chemical bases it is expected the same action can be performed by humic substances (HSs), ubiquitous natural compounds arising from chemical and biological degradation of biomasses, since they are melanin-like polymers. Despite high potential of HSs, their application in the pharmaceutical and cosmetic fields has not been yet explored, probably due to poor knowledge of structure-property-function relationships.
Following a bioinspired approach, we have recently proposed a novel synthetic strategy whereby an inorganic semiconductor (TiO_2) sol acts as a catalyst and a templating agent for 5,6- dihydroxyindole-2-carboxylic acid (DHICA) polymerization to eumelanin, ultimately leading to hybrid nanostructures with unique biological properties [2,3].
Following a similar approach, HSs have been polymerized through photo-oxidative heterogeneous catalysis [4].
This stimulating background, joined with non-toxic and bio-friendly nature of both organic and inorganic components prompted submission of the present proposal that aims at **designing organic-inorganic hybrids involving eumelanin like biopolymers and a ceramic phase (SiO_2,TiO_2) as active antiaging formulations**.This objective will be pursued through a global **bioinspired and bio-sustainable approach** that exploits Nature's structures and principles (**melanin based systems**) to upregulate ROS production and develops **biologically active materials starting from inexpensive raw material resources**.
As a key contribution to the fundamental research in the field, the projects aims to:

- Assess structure-property-function relationships in melanin-type biopolymers in order to optimize antioxidant as well as bioactive properties;
- Implement novel synthesis strategies of hybrid materials, wherein the inorganic phase plays an active role in tuning biological properties of the finals systems, in terms of greater chemical stability and overall antioxidant activity. The most intriguing issue concerns the influence that an inorganic red-ox active semiconductor oxide can have on red-ox equilibria within melanin like oligomers and that ultimately define their antioxidant efficacy.

From a technological point of view, addressing these still open issues will provide the concrete opportunity to recycle bio-wastes and convert them into high value nutraceutical/cosmetic products and drugs.
Both research strategy and breakthroughs of the proposal target priorities of RIS3 strategy, with a marked transversal feature between provided strategic paths, as well as the Horizon 2020 pillars as an interdisciplinary research with a focus on human health and a primary commitment to advancement of knowledge, innovation and enabling technologies.

1. Chem. Soc. Rev. 2011, 40, 2909
2. J. Phys. Chem C., 2016, 120, 6262−6268.
3. J. Mater Chem B, 3 (14), 2015, 2808-2815.
4 . Biol Fertil Soils (2016) 52:585–593.

Informazioni sintetiche relative a: attrezzature/software disponibili, disponibilità finanziaria, collaborazioni con altri enti di ricerca italiani e ed esteri (eventualmente anche con aziende) potenzialmente rilevanti con riferimento specifico alla tematica proposta.

Equipment and Facilities:

- FT-IR spectrometer for attenuated total reflectance (ATR), diffuse reflectance (DRIFT) and transmittance mode experiments
- Thermogravimetric Analysis apparatus (TGA)
- Thermogravimetric/Differential Scanning Calorimeter (TG/DSC) simultaneous analyzers equipped with gas analysis through FT-IR spectrometry
- Controlled atmosphere high temperature ovens
- Spin-coater
- Dip-coater
- Electrospinning apparatus

Straight access to:

- X-Ray diffraction (XRD) measurements
- Electronic Paramagnetic Resonance (EPR) Spectroscopy
- UV-Vis Spectroscopy
- Neutron scattering (SANS, NR) spectroscopy
- Nuclear Magnetic Resonance Spectroscopy

Achievement of the project goals is realistic in view of the synergy among a multidisciplinary team with complementary expertise in the design of hybrid materials, physical chemistry of supramolecular/nanocomposite structures, biochemical and microbiological systems, chemistry of humic substances as detailed in the following:

- Dept. of Chemical Sciences, University of Napoli Federico II, Dr. Alessandro Pezzella, Prof. M. D'Ischia, Prof. G. D'Errico
- Dept. of Biology, University of Naples Federico II, Prof. M. Varcamonti
- Centro Interdipartimentale di Ricerca sulla Risonanza Magnetica Nucleare per l'Ambiente, l'Agroalimentare ed i Nuovi Materiali (CERMANU), Prof. Alessandro Piccolo, Dott.ssa Filomena Sannino

Strategic for a positive outcome of the PhD project will be also cooperation with:

- Dept. of Civil, Environmental and Mechanical Engineering, University of Trento, Prof Matteo Leoni.

Informazioni sintetiche relative ad eventuale periodo all'estero previsto per il dottorando (periodo, gruppo di ricerca, Università, ente di Ricerca….)

The PhD student is expected to spend a training and research period abroad in one of the following Universities or Research Institute:

- Ecole Nationale Supérieure des Mines de Saint Etienne, Gardanne, France
  Materials Science and Engineering Department, University of Washington, Seattle, WA, United States
- Département de Génie Chimique, École Polytechnique de Montréal, C.P. 6079, Succ. Centre-ville, Montréal, QC, Canada

Il sottoscritto garantisce, sotto la propria responsabilità, di poter accedere a risorse tecniche e finanziare adeguate a supportare le attività necessarie al corretto sviluppo del progetto di ricerca proposto.

Napoli, _19/07/2016_ Firma del richiedente: