



**Decree of the Rector n. 668 of 11/07/2024**

Competition for awarding 1 research grant at the University of Udine

**DISCLAIMER:**

The official and legally binding call for applications is in Italian only.

This document cannot be used for legal purposes and is only meant to provide information in English on the call for applications (Decree of the Rector n. 668 of 11/07/2024). Please refer to the official call published on: <https://www.uniud.it/it/albo-ufficiale>

Any change and integration will be made available on the above-mentioned web page. Therefore, no personal written communication regarding the examination date and/or competition results shall be provided to applicants.

**Annex 1**

**Call for applications for the award of 1 grant for the performance of research activities at the University of Udine on the topic "Microstructural optimization and surface engineering to decrease mechanical degradation of metal alloys produced by additive manufacturing" SSD: IIND-03/C (principal investigator, Alex Lanzutti)**

**Art. 1**

A selection proceeding is hereby announced for the award of 1 research grant at the University of Udine for the performance of the research activity identified in Annex A, which forms an integral and substantial part of this call. The research grant is linked to the research project on which it is based and is subject to the corresponding financial coverage.

The grant may be renewed with the winner in accordance with the provisions of Article 22 of Law no. 240 of 30 December 2010 (in the text prior to Leg. Decree no. 36 of 30 April 2022, converted with amendments by Law no. 79 of 29 June 2022) and the Regulations of the University of Udine for the awarding of research grants issued by Rector's Decree no. 182 of 31 March 2021, in the presence of a positive assessment by the scientific supervisor of the activity carried out by the research fellow, adequate scientific justification and related financial coverage, within the limits set out in Article 3, letters b) and c) below.

The research grant does not entitle the successful candidate to any rights as regards access to University roles.

Any personal communication to candidates relating to this selection will be sent exclusively to the email address indicated in the application form.

**Art. 2**

The activities covered by the research grant referred to in this call for competition and the admission requirements are indicated and described in Annex A. Failure to meet the admission requirements at the time of applying shall result in the **exclusion** of the candidate from the selection process.



Possession of a PhD qualification or equivalent qualification obtained abroad or, for the sectors concerned only, of a medical specialisation qualification accompanied by an adequate scientific production, constitutes a preferential requirement for the awarding of the grant envisaged for this selection, if it has not been mentioned as an admission requirement.

The Selection Board shall assess, for the sole purpose of admission to the competition, the suitability of any qualification obtained abroad, without prejudice to the assessment of the medical specialisation qualification to which Article 38, paragraph 3.1 of Legislative Decree 165/2001, as amended, and the relevant Community regulations apply.

The Board assesses the qualification obtained abroad based on the relevant documentation enclosed with the application to take part in the selection and may exclude the candidate if the submitted documentation does not provide sufficient elements for the assessment.

Candidates are therefore invited to enclose all documentation in their possession relating to their qualifications in order to provide the Board with sufficient elements to assess their position.

Candidates are admitted to the selection process subject to a reservation and their exclusion, for failure to meet the requirements, may be ordered at any time by reasoned decision.

#### Art. 3

The research grant referred to in this call cannot be awarded to the following subjects:

- a) Employees of Universities and the entities referred to in Article 22(1) of Law no. 240 of 30 December 2010 (in the text prior to Leg. Decree no. 36 of 30 April 2022, converted with amendments by Law no. 79 of 29 June 2022).
- b) Recipients of previous research grants pursuant to Law no. 240 of 30 December 2010, for the maximum period allowed by the regulations, excluding the period in which the grant was received in conjunction with a PhD, up to the legal duration of the relevant course.
- c) Those who have already been awarded research grants and fixed-term researcher contracts pursuant to Law no. 240 of 30 December 2010 for a total of 12 years, even if not consecutive.
- d) Those who have a degree of kinship or relationship, up to and including the fourth degree, with:
  - The Rector, the Director General or a member of the Board of Directors of the University of Udine.
  - The principal investigator or a professor/researcher belonging to the department or structure of interest where the research grant activity takes place.

The research grant referred to in this call cannot be cumulated with the following:

- a) Awarded scholarships of any kind, except those granted by national or foreign institutions useful for supplementing, by means of stays abroad, the fellow's training or research activities.
- b) Other research grants.
- c) Employment relationships, even if part-time, without prejudice to the provisions of the regulations for employees of public administrations.

The grant referred to in this call is also incompatible with simultaneous attendance of degree courses, master's degrees, and PhDs with scholarships and medical specialisation, in Italy and abroad.

Persons who have been convicted of a criminal offence resulting in disqualification from holding public office or inability to contract with the public administration as a secondary penalty are not eligible for selection.



Art. 4

Applicants must submit, in the manner described in Article 5 below, the application to take part in the selection, duly signed in handwritten or digital form. An application without a signature will result in the **exclusion** of the candidate, except in the case of access through the use of the Public Digital Identity System (SPID) in which case the signature will not be necessary.

The application must be uploaded in its entirety (i.e., every page), **otherwise** the applicant will be **excluded** from the selection.

Applicants must enclose the following with their application for participation in the selection, **under penalty of exclusion**:

1. The professional scientific *curriculum vitae* in Italian or English or one of the additional languages, if any, indicated in Annex A, highlighting the candidate's aptitude for carrying out and implementing the research programme.
2. Copy of valid identity document or other identification document. Citizens of non-EU countries must enclose a copy of their passport.
3. Limited to citizens of non-EU states residing or authorised to reside in Italy, a copy of their residence permit or authorisation to reside in Italy.
4. For candidates who cannot provide a self-certification under the conditions set out below, documentation proving possession of the academic qualification required for admission to the selection. Possession of a higher academic qualification does not exempt the candidate from producing such documentation, which, if missing, will result in exclusion:
  - **Candidates who are Italian citizens or citizens of a European Union Member State** must submit a declaration in lieu of certification and, if necessary, a notarial deed regarding the academic qualification needed for admission (indicating the academic qualification, the academic institution awarding the qualification, the year it was awarded and the mark obtained) and the publications and other qualifications held, indicating for each one all the identification details necessary for the Board's assessment. **The application for participation counts as a declaration in lieu of certification of the declared academic qualification.** If the subject matter of the declaration is not clearly identified in terms of its nature, duration, time setting and institution concerned, the selection board will disregard it. The Administration reserves the right to carry out appropriate checks on the truthfulness of the content of the declarations made; in the event of a false declaration, the provisions of Article 76 of Presidential Decree no. 445/2000 and Articles 483, 485, and 486 of the Italian Criminal Code shall apply. The University will not take into account any certificates attached by candidates who are Italian citizens or citizens of a state belonging to the European Union.
  - **Citizens of a non-European Union State** must submit documents and qualifications in Italian or English or one of the additional languages, if any, indicated in Annex A, under penalty of exclusion from the selection or, as the case may be, non-assessment.  
Documents and titles, originally in a different language, must be accompanied by a translation, made by the candidate under his or her responsibility, into Italian or English or any other language indicated in Appendix A. With reference to the dissertation only, the translation may be limited to an extended abstract.
  - **Citizens of a non-EU State regularly residing in Italy** may use declarations in lieu of certification only in respect of states, personal qualities or facts that can be certified or attested to by Italian public bodies, without prejudice to the special provisions contained in the laws and regulations governing immigration and the status of foreigners.
  - **Citizens of non-EU states authorised to reside in Italy** may use the aforementioned declarations in cases where they are produced pursuant to international conventions between Italy and the declarant's country of origin.



Applicants may also enclose with their application for assessment purposes their publications and any other qualification deemed useful to prove their qualification in relation to the research programme described in Annex A and to certify any research activity carried out in public and/or private entities (with the indication of the starting date and duration). The submission modalities are similar to those indicated in point 4 of the previous paragraph.

Only the qualifications possessed by the candidate on the date of submission of the application for selection and presented in accordance with Article 5 will be assessed.

Any exclusion from the selection procedure due to lack of eligibility requirements, absence of mandatory documents, failure to sign the application to take part in the selection or submission of the application in a manner other than that provided for in this call will be communicated to the parties concerned exclusively by email to the email address indicated in the application to take part in the selection.

#### Art. 5

Registration for this selection will begin on July 18, 2024 at 2:00 pm (Italian time) and will end on August 23, 2024 at 2:00 pm (Italian time).

The application to take part in the selection must be completed, under penalty of exclusion, using the appropriate online procedure, available at <https://pica.cineca.it/>.

For those who do not already have a user account, the procedure involves a registration phase for the applicant, and a subsequent phase for completing the application online.

Once completed, the application must be signed in the manner (handwritten signature, with attached identity document, or digital signature) described in the online procedure, under penalty of exclusion from the selection. The application does not have to be signed if the above-mentioned online procedure is accessed using the Sistema Pubblico di Identità Digitale (SPID - Digital ID Public System). In the case of a handwritten signature, the applicant must upload the application to the system in its entirety. The information entered in the application form shall constitute a declaration in lieu of certification and affidavit, pursuant to Articles 46 and 47 of Presidential Decree no. 445/2000.

The qualifications referred to in Article 4 must be attached to the application in .pdf format. Individual files, in .pdf format, may not exceed 30MB in size.

It is not permitted to submit attachments to the application in the form of links to files residing on "online storage/file sharing" services or web pages. Reference may not be made to documents or publications submitted to this or other administrations or documents attached to the application for participation in another selection procedure.

The application for participation in the selection is automatically sent to the University of Udine with the final closure of the online procedure.

The University Administration:

- accepts no liability if it is impossible to read the submitted documentation in electronic format due to damaged files;
- does not accept or take into consideration qualifications or documents received in paper form or by any other means than those specified in this article.



The Administration accepts no liability in the event of incorrect indication by the candidate of his/her email address or in the event of failure or delay in communicating a change in the email address indicated in the application, nor for any digital transmission errors attributable to third parties, unforeseeable circumstances or force majeure.

Applicants are advised not to wait until the last few days before the deadline to submit their application. The University accepts no liability for any malfunctions due to technical problems and/or overloading of the communication line and/or application systems.

#### Art. 6

The selection test takes place according to the modalities set out in Annex A.

The test will aim to ascertain the candidates' preparation, experience and research aptitude. It will consist of an assessment of the professional scientific curriculum, publications and titles submitted, and an interview, where applicable.

Failure of the candidate to attend the interview will be considered as withdrawal from the selection, whatever the cause.

Candidates who intend to avail themselves of the benefits provided for by Article 20 of Law no. 104 of 1992 (need for assistance, possible use of additional time for the performance of examination tests) in relation to their disability situation, must declare this and accompany the application with appropriate medical certification in order to allow the Administration to prepare in time the means and tools to guarantee the statutory benefits; failure to submit the medical certification exempts the Administration from any obligation in this regard.

#### Art. 7

The Competition Selection Board is identified in Annex A to this call, of which it forms an integral part. At its first meeting, the Board appoints the Chairperson and the Secretary taking the minutes, and establishes the criteria and procedures for assessing the qualifications and the interview, where applicable.

The results of the assessment must be made known to the parties concerned at the interview, where provided for.

The Board can attribute to the selection a total number of 100 points (one hundred hundredths). At the end of its work, the Board formulates the overall merit list based on the total marks obtained by each candidate and draws up the minutes of the competition operations.

The grant may be awarded, subject to the ranking list, to candidates who have obtained a minimum overall mark of 70/100 (seventy hundredths).

The Board's judgement is final on the merits.

The ranking list will be made public exclusively by publication on the University's official notice board; the outcome of the assessment will not be the subject of personal communication to candidates.

Those who do not declare their acceptance of the research grant and do not present themselves at the structure where the research activities are to be carried out to sign the contract by the deadline communicated by the same to the email address indicated by the candidate in the application shall forfeit their right to the research grant, except for health reasons or reasons of force majeure duly documented and promptly notified.



Candidates holding qualifications obtained abroad, if successful, must submit the following, if not already attached to the application:

- **For degrees issued by a country that is a party to the Lisbon Convention (<https://www.enic-naric.net/>), the following documentation:**
  - *Supplement* Diploma or similar certificate in English issued by the competent University.
  - "Certificate of Verification of Foreign Qualification - CIMEA" issued by CIMEA (Centre for Information on Academic Mobility and Equivalences) via the "*diplome*" service at <https://cimea.diplome.eu/udine/#/auth/login>
- **For degrees issued by a country not party to the Lisbon Convention (<https://www.enic-naric.net/>), one of the following options:**
  - Declaration of the on-site value of the qualification held and the certificate relating to the qualification with examinations and grades. The certificate in a language other than Italian or English must be accompanied by an official translation into one of those languages (certified by the competent diplomatic-consular authority or sworn at a court in Italy).
  - "Certificate of Comparability and Verification of Foreign Qualifications - CIMEA" issued by CIMEA (Centre for Information on Academic Mobility and Equivalences) via the "*diplome*" service at <https://cimea.diplome.eu/udine/#/auth/login>

If the aforementioned documentation is not available at the time of the conclusion of the contract, the candidate must prove that he or she has requested it and submit it as soon as possible; if it is not submitted within six months of the start of the contract, the candidate will forfeit the contract and will be required to repay any related sums received to date.

#### Art. 8

The research activity cannot be started before the contract defining the terms of the collaboration is signed.

The activity covered by the research grant must have the following characteristics:

- a) Be carried out in the context of the research programme covered by the grant and not be a purely technical support to the same.
- b) Close connection with the implementation of the research programme that is the subject of the relationship with the winner.
- c) Having a continuous and in any case temporally defined character, not merely occasional, and in coordination with the overall activity of the University.
- d) Performance in a condition of autonomy, within the sole limits of the programme prepared by the Head of the same, without predetermined working hours.

The research fellow is obliged to submit a detailed written report on the work carried out and the results achieved, together with the opinion of the scientific supervisor, to the reference structure within the deadlines laid down in the contract. The research fellow will also have to submit interim reports and time sheets if requested by the reference structure and/or the scientific supervisor.

The research fellow is bound to strict confidentiality regarding the data and information to which he/she becomes privy in the course of his/her research activity. At the request of the scientific coordinator, he/she will be required to sign an appropriate confidentiality agreement.

The industrial property rights to the results obtained by the research fellow in the performance of the research activity belong exclusively to the University, without prejudice to the moral right of the research fellow to be recognised as an author or inventor.





The University reserves the right to revoke this call for competition for reasons of public interest, should the research project and/or the financial backing on which the research grant is based cease to exist. Should these causes arise after the contract has been signed, the University may terminate the contract without notice.

**Art. 9**

The following apply to the grant under this call:

- On tax matters, the provisions of Article 4 of Law no. 476 of 13 August 1984, as amended.
- On social security matters, the provisions of Article 2(26) et seq. of Law no. 335 of 8 August 1995, as amended.
- On compulsory maternity leave, the provisions of the Ministerial Decree of 12 July 2007.
- On sick leave, the provisions of Article 1(788) of Law No 296 of 27 December 2006, as amended.

During the period of compulsory maternity leave, the allowance paid by INPS pursuant to Article 5 of the Ministerial Decree of 12 July 2007 is supplemented by the University up to the full amount of the research grant.

The grant will be paid in monthly instalments in arrears.

**Art. 10**

The data collected as part of the procedure referred to in Article 5 is necessary for the proper management of the selection procedure, for the possible subsequent management of the research grant and purposes related to the management of the services provided by the University. The University of Udine is the Data Controller. At any time, the data subject may request access, rectification and, compatibly with the institutional purposes of the University, cancellation and restriction of processing or may object to the processing of his/her data. He/she can always lodge a complaint with the Italian Data Protection Authority. The full information is available on the University of Udine website in the "Privacy" section accessible from the home page [www.uniud.it](http://www.uniud.it) Direct Link: <https://www.uniud.it/it/it/pagine-speciali/guida/privacy>

**Art. 11**

For any matters not expressly mentioned in this call, reference is made to the relevant regulations in force cited in the introduction and to the "Internal regulations for the award of research grants pursuant to Law no. 240 of 30 December 2010" of the University of Udine issued by Rector's Decree no. 182 of 31 March 2021.

**Art. 12**

The official in charge of the proceeding is Dr. Sandra Salvador, Head of the Research Services Area of the University of Udine.

The reference office at the University of Udine is the "Area Servizi per la Ricerca - Ufficio Formazione per la Ricerca", Via Mantica 31 - 33100 Udine.

To request information on the call, please complete the following form available on the University of Udine website: [https://helpdesk.uniud.it/SubmitSR.jsp?type=req&accountId=universitofudine&populateSR\\_id=42105](https://helpdesk.uniud.it/SubmitSR.jsp?type=req&accountId=universitofudine&populateSR_id=42105)



**Annex A**

**Responsabile scientifico della ricerca / Principal investigator:**

Nome e cognome / Name and surname: Alex Lanzutti  
 Qualifica / Position: Professore Associato / Associate Professor  
 Dipartimento / Department: Politecnico di Ingegneria e Architettura (DPIA) / Polytechnic of Engineering and Architecture  
 Area MUR / Research field: 09 - Ingegneria industriale e dell'informazione  
 Settore concorsuale e Settore scientifico disciplinare / Scientific sector: 09/IIND-03; IIND-03/C - Metallurgia

**Titolo dell'assegno di ricerca / Topic of the research fellowship "assegno di ricerca":**

*I bandi sono consultabili dal sito dell'Ateneo, del MUR e di Euraxess / The calls are available on the University, MUR and Euraxess websites*

Testo in italiano:

Ottimizzazione microstrutturale ed ingegnerizzazione delle superfici per diminuire il degrado meccanico di leghe metalliche prodotte per additive manufacturing.

Text in English:

Microstructural optimization and surface engineering to decrease mechanical degradation of metal alloys produced by additive manufacturing.

**Obiettivi previsti e risultati attesi del programma di ricerca in cui si colloca l'attività dell'assegnista di ricerca / Foreseen objectives and results of the research programme performed by the research fellow "assegnista di ricerca":**

*I bandi sono consultabili dal sito dell'Ateneo, del MUR e di Euraxess / The calls are available on the University, MUR and Euraxess websites*

Testo in italiano:

Abstract del progetto	<p>Il progetto verte a migliorare le proprietà meccaniche e superficiali di materiali metallici prodotti con stampa 3D mediante trattamenti termici massivi non convenzionali, trattamenti termochimici superficiali o rivestimenti. Per tale scopo il candidato lavorerà su materiali, principalmente leghe di Ti Co o INOX, prodotti da laboratori interni UNIUD o su materiali forniti da enti provati a scopo ricerca. In particolare le attività principali saranno svolte presso il laboratorio LAMIS dove verranno svolte le caratterizzazioni dei materiali o gli eventuali trattamenti termici. La ricerca verterà principalmente sull'ottimizzazione del materiale per migliorarne la resistenza al degrado tribologico o a fatica. A tale scopo verranno eseguite delle caratterizzazioni microstrutturali e chimiche seguite da caratterizzazioni meccaniche classiche. Saranno quindi analizzati i dati per determinare il trattamento ottimo per una classe di materiale.</p> <p>I risvolti della ricerca saranno importanti sia per UNIUD stessa che per il territorio e porterà alla produzione di dati scientifici di sicuro impatto nazionale e internazionale.</p>
Obiettivi del progetto	<p>Per lo svolgimento di tali attività risulterà necessario sviluppare degli opportuni piani di lavoro riguardanti la definizione delle temperature e dei tempi di trattamento termico, oltre che delle velocità di raffreddamento. Le attività potranno essere svolte utilizzando dei forni a muffola, eventualmente anche in atmosfera protetta. Il raffreddamento potrà avvenire in diversi mezzi, tra i quali acqua, olio, aria forzata, aria calma ed</p>





	<p>in forno. Dai campioni trattati potranno poi essere effettuate delle analisi microstrutturali al microscopio ottico, dopo opportuna preparazione metallografica, ed al microscopio a scansione elettronica (SEM). Potranno inoltre essere eseguite numerose caratterizzazioni di tipo meccanico attraverso prove di usura (con diversi contatti tribologici), prove di trazione, test di durezza e prove di fatica con metodo stair case. Sarà inoltre di notevole importanza l'analisi della texture superficiale, oltre che la valutazione della presenza di difetti interni che possono compromettere notevolmente le proprietà già descritte. Lo scopo dell'attività sarà principalmente quello di correlare le microstrutture ottenute dopo trattamento termico con tali proprietà. Ulteriori attività potranno essere svolte per condizionare le proprietà superficiali, come ad esempio dei trattamenti termochimici (nitrazione, cementazione), svolti anche a bassa temperatura. Anche in questo caso le attività avranno lo scopo di determinare le proprietà chimiche (attraverso la tecnica GDOES), meccaniche (microdurezza, usura) correlandole alla microstruttura (SEM, microscopia ottica), con particolare attenzione alle superfici. Di fondamentale importanza sarà anche la caratterizzazione dei campioni testati meccanicamente, in particolare valutando le morfologie di frattura al fine di identificare le possibili cause di fragilità del materiale. In particolare, per le prove di caratterizzazione microstrutturale e meccanica verranno impiegate le attrezzature a disposizione del laboratorio di materiali.</p>
Stato dell'arte	<p>Le tecnologie di produzione additive sono attualmente in notevole via di sviluppo grazie all'intensa ricerca che viene svolta negli ultimi anni. In particolare, tra le tecnologie additive riguardanti i metalli, quelle a letto di polvere sono le maggiormente utilizzate e le più promettenti per quanto riguarda la possibile industrializzazione. In aggiunta, le altre tecnologie che trovano ampio utilizzo nel settore sono le tecniche fascio elettronico (EB-PBF) e le tecniche laser (L-PBF). I prodotti ottenuti per tecnologia additiva vengono utilizzati in numerosi campi di applicazione che spaziano dal biomedicale al settore dell'oil and gas, passando per il campo dei trasporti. Solitamente le leghe stampate con le tecniche descritte, allo stato stampato, presentano delle proprietà sorprendentemente diverse rispetto alle leghe equivalenti prodotte con le tecniche tradizionali. Tali processi produttivi lasciano però nelle leghe stampate diversi problemi come una rugosità superficiale piuttosto grossolana, delle tensioni residue ed una microstruttura fortemente metastabile. Tutte queste proprietà possono avere un'influenza positiva o negativa su aspetti quali la resistenza alla corrosione, la resistenza a fatica e ad usura oltre che a numerose altre proprietà specifiche. Attualmente la ricerca scientifica su tali materiali è fortemente focalizzata sullo studio dei trattamenti post stampa che hanno lo scopo di condizionare sia la microstruttura, al cuore del componente ed in superficie, che la texture superficiale, allo scopo di migliorare le prestazioni dei componenti prodotti con le tecniche additive. In particolare, il progetto di ricerca verterà principalmente sullo studio di trattamenti termici e/o superficiali di leghe a base Fe (principalmente AISI 316L), leghe di Ti (Ti gr.5) e leghe di CoCr prodotte con tecniche laser o a fascio elettronico.</p> <p>Attualmente il gruppo di ricerca ha già notevole esperienza sulle attività di ricerca nell'ambito dello studio delle superfici che dei trattamenti termici massivi per condizionare le proprietà massive e delle superfici dei materiali. In particolare, studi recenti sono stati svolti per il condizionamento delle superfici [1,2], in particolare su leghe INOX</p>



	<p>mediante processi di cementazione, e lo studio dei trattamenti termici dei materiali prodotti per additive manufacturing. Diversi studi sono stati svolti per conoscere al meglio il degrado meccanico dei materiali [3–8] prodotti per additive manufacturing, in particolare modo per le proprietà di resistenza ad usura o a fatica di tali materiali.</p>
Descrizione del progetto	<p>Il progetto verrà sviluppato in collaborazioni con altre università nazionali o enti privati che producono principalmente componenti con tecniche di stampa 3D di metalli o trattamenti superficiali. Le attività comunque verranno svolte presso il laboratorio dei materiali e ingegneria delle superfici (LAMIS) dell'università di Udine, in collaborazione con altri gruppi di ricerca quali il LAMA o il gruppo SIMED del DPIA. Per quanto concerne i trattamenti eseguiti, potranno essere dei trattamenti termici massivi, a cui i materiali per additive rispondono in maniera non convenzionale rispetto agli equivalenti prodotti con tecniche tradizionali, o trattamenti termochimici e non superficiali. Tra i trattamenti termochimici si lavorerà soprattutto nell'ambito della cementazione a bassa temperatura su acciai inox austenitici. Mentre per quanto concerne i rivestimenti superficiali saranno principalmente studiati rivestimenti galvanici o depositati con tecnica PVD.</p> <p>Le attività di trattamento termico dei materiali verranno svolte presso il laboratorio LAMIS che è dotato di forni per il trattamento termico dei materiali.</p> <p>Le caratterizzazioni microstrutturali verranno svolte con analisi al microscopio ottico o SEM, per i materiali massivi e/o rivestiti. Sarà possibile quindi una caratterizzazione chimica della superficie o del bulk con tecnica GDOES. La caratterizzazione meccanica potrà essere fatta sui campioni prodotti opportunamente attraverso la macchina universale in dotazione al laboratorio per determinare le proprietà statiche e dinamiche dei materiali trattati e non trattati superficialmente. Potranno essere quindi studiate le proprietà di resistenza ad usura dei materiali rivestiti e non anche ad alta temperatura. Oltre a poter determinare anche le proprietà di durezza dei materiali rivestiti e non. I metalli presi in considerazione saranno leghe base Fe (principalmente INOX), leghe di Ti e Co. Queste leghe saranno prodotte con tecniche L-PBF. I risultati ottenuti dalle diverse caratterizzazioni saranno valutati e analizzati in maniera incrociata per comprendere meglio quali siano i parametri di trattamento che offrono le migliori prestazioni.</p>
Possibili potenzialità applicative	<p>Il progetto si inserisce in un settore in continua crescita che è quello della manifattura additiva in cui ci sono diverse criticità inerenti sia la difettologia interna dei materiali stampati che il condizionamento delle superfici. I risultati ottenuti sono di sicuro interesse sia per le attività relative all'università di Udine, da cui potranno essere previste delle pubblicazioni in ambito internazionale o presentazione a convegni nazionali e internazionali, sia sul territorio in quanto con tale progetto sarà incrementata sia la conoscenza dei processi di additive manufacturing che i processi di condizionamento del materiale attraverso trattamenti termici o trattamenti superficiali. Non da trascurare, data la tematica trattata, la possibilità di poter competere per qualche finanziamento competitivo su scala nazionale o internazionale (Horizon, Interreg, PRIN, PON-FESR, etc.).</p>



<b>Bibliografia</b>	<p>[1] R. Montanari, A. Lanzutti, M. Richetta, J. Tursunbaev, E. Vaglio, A. Varone, C. Verona, Plasma Carburizing of Laser Powder Bed Fusion Manufactured 316 L Steel for Enhancing the Surface Hardness, (2022) 1–13.</p> <p>[2] E. Bolli, S. Kaciulis, A. Lanzutti, A. Mezzi, R. Montanari, A. Palombi, F. Sordetti, E. Vaglio, A. Varone, C. Verona, Surface characteristics and tribological behavior of 3D-printed 316 L steel after plasma assisted low temperature carburizing, Surf. Coatings Technol. 477 (2024). doi:10.1016/j.surfcoat.2023.130295.</p> <p>[3] A. Lanzutti, M. Magnan, E. Vaglio, G. Totis, M. Sortino, L. Fedrizzi, Study of the Effect of L-PBF Technique Temporal Evolution on Microstructure, Surface Texture, and Fatigue Performance of Ti gr. 23 Alloy, Metals (Basel). 13 (2023). doi:10.3390/met13071247.</p> <p>[4] E. Marin, M. Pressacco, S. Fusi, A. Lanzutti, S. Turchet, L. Fedrizzi, Characterization of grade 2 commercially pure Trabecular Titanium structures, Mater. Sci. Eng. C. 33 (2013). doi:10.1016/j.msec.2013.02.034.</p> <p>[5] A. Lanzutti, E. Marin, K. Tamura, T. Morita, M. Magnan, E. Vaglio, F. Andreatta, M. Sortino, G. Totis, L. Fedrizzi, High temperature study of the evolution of the tribolayer in additively manufactured AISI 316L steel, Addit. Manuf. 34 (2020) 101258. doi:10.1016/j.addma.2020.101258.</p> <p>[6] R.I. Revilla, B. Wouters, F. Andreatta, A. Lanzutti, L. Fedrizzi, I. De Graeve, EIS comparative study and critical Equivalent Electrical Circuit (EEC) analysis of the native oxide layer of additive manufactured and wrought 316L stainless steel, Corros. Sci. 167 (2020). doi:10.1016/j.corsci.2020.108480.</p> <p>[7] F. Andreatta, A. Lanzutti, E. Vaglio, G. Totis, M. Sortino, L. Fedrizzi, Corrosion behaviour of 316L stainless steel manufactured by selective laser melting, Mater. Corros. 70 (2019). doi:10.1002/maco.201910792.</p> <p>[8] E. Marin, R. Offoach, A. Lanzutti, M. Regis, S. Fusi, L. Fedrizzi, Hybrid diffusive/PVD treatments to improve the tribological resistance of Ti-6Al-4V, Biomed. Mater. Eng. 24 (2014). doi:10.3233/BME-130845.</p>
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Text in English:

<b>Abstract</b>	<p>The project is concerned with improving the mechanical and surface properties of metal materials produced by 3D printing through unconventional massive heat treatments, thermochemical surface treatments or coatings. For this purpose, the candidate will work on materials, mainly Ti Co or stainless steels, produced by UNIUD in-house laboratories or on materials provided by proven entities for research purposes. In particular, the main activities will be carried out at the LAMIS laboratory where characterizations of materials or possible heat treatments will be performed. The research will mainly focus on optimizing the material to improve its resistance to tribological or fatigue degradation. To this end, microstructural and chemical characterizations will be performed followed by classical mechanical characterizations. Data will then be analyzed to determine the optimal treatment for a class of material.</p> <p>The implications of the research will be important for UNIUD itself as well as for the local area and will lead to the production of scientific data of definite national and international impact.</p>
<b>Objectives of the project</b>	<p>In order to carry out these activities, it will be necessary to develop appropriate work plans concerning the definition of heat treatment temperatures and times, as well as cooling rates. The activities may be carried out using muffle furnaces, possibly even in a protected atmosphere. Cooling may take place in a variety of media, including water, oil, forced air, still air and in a furnace. From the treated samples, microstructural analyses may then be carried out under an optical microscope, after appropriate metallographic preparation, and under a</p>



	<p>scanning electron microscope (SEM). Numerous mechanical characterizations through wear tests (with different tribological contacts), tensile tests, hardness tests, and fatigue tests using the stair case method may also be performed. The analysis of surface texture will also be of considerable importance, as well as the evaluation of the presence of internal defects that may greatly impair the properties already described. The aim of the activity will be mainly to correlate the microstructures obtained after heat treatment with these properties. Additional activities may be carried out to condition surface properties, such as thermochemical treatments (nitriding, cementation), also carried out at low temperature.</p> <p>Again, activities will aim to determine chemical (through the GDOES technique), mechanical (microhardness, wear) properties by correlating them with microstructure (SEM, optical microscopy), with particular attention to surfaces. Also of paramount importance will be the characterization of mechanically tested specimens, particularly by evaluating fracture morphologies in order to identify possible causes of material brittleness. In particular, the equipment available in the materials laboratory will be used for microstructural and mechanical characterization tests.</p>
<p>State of the art</p>	<p>Additive manufacturing technologies are currently undergoing considerable development due to the intensive research being carried out in recent years. In particular, among additive technologies concerning metals, powder bed technologies are the most widely used and the most promising in terms of possible industrialization. In addition, the other technologies that are widely used in the field are electron beam techniques (EB-PBF) and laser techniques (L-PBF). Products made by additive technology are used in numerous fields of application ranging from biomedical to oil and gas and transportation.</p> <p>Usually, alloys printed by the techniques described, in their printed state, exhibit strikingly different properties than equivalent alloys produced by traditional techniques. However, such production processes leave in the molded alloys several problems such as a rather coarse surface roughness, residual stresses and a strongly metastable microstructure. All these properties can have a positive or negative influence on aspects such as corrosion resistance, fatigue and wear resistance as well as numerous other specific properties.</p> <p>Currently, the research group already has considerable experience on research activities in the area of studying surfaces that massive heat treatments to condition massive and surface properties of materials. In particular, recent studies have been carried out for surface conditioning [1,2], particularly on INOX alloys by carburizing processes, and the study of heat treatments of materials produced by additive manufacturing. Several studies have been carried out to learn more about the mechanical degradation of materials [3-8] produced by additive manufacturing, especially the wear or fatigue properties of such materials.</p>
<p>Project description</p>	<p>The project will be developed in collaborations with other national universities or private entities that mainly produce components with metal 3D printing techniques or surface treatments. The activities however will be carried out at the Laboratory of Materials and Surface Engineering (LAMIS) of the University of Udine, in collaboration with other research groups such as LAMA or the SIMED group of DPIA. As for the treatments performed, they may be massive thermal treatments, to which additive</p>



	<p>materials respond in an unconventional way compared to equivalents produced by conventional techniques, or thermochemical and non-surface treatments. Among thermochemical treatments, work will be done mainly in the area of low-temperature carburizing on austenitic stainless steels. While with regard to surface coatings, galvanic or PVD-deposited coatings will be mainly studied.</p> <p>Materials heat treatment activities will be carried out at the LAMIS laboratory, which is equipped with furnaces for heat treatment of materials. Microstructural characterizations will be carried out by optical microscope or SEM analysis for massive and/or coated materials. Chemical characterization of the surface or bulk by GDOES technique will then be possible. Mechanical characterization may be done on the specimens produced appropriately through the universal machine provided by the laboratory to determine the static and dynamic properties of surface-treated and non-surface-treated materials. The wear resistance properties of coated and uncoated materials even at high temperature can then be studied. In addition to also being able to determine the hardness properties of coated and uncoated materials. The metals under consideration will be Fe base alloys (mainly INOX), Ti and Co alloys. These alloys will be produced by L-PBF techniques. The results obtained from the different characterizations will be cross-validated and analyzed to better understand which treatment parameters provide the best performance.</p>
Possible application potentialities	<p>The project is part of a growing field that is that of additive manufacturing in which there are several critical issues inherent to both the internal defectology of printed materials and the conditioning of surfaces. The results obtained are of certain interest both for activities related to the University of Udine, from which publications in the international arena or presentations at national and international conferences may be expected, and on the territory since with this project both the knowledge of additive manufacturing processes and material conditioning processes through heat treatments or surface treatments will be increased. Not to be overlooked, given the subject matter, is the possibility of being able to compete for some competitive funding on a national or international scale (Horizon, Interreg, PRIN, PON-FESR, etc.).</p>
References	<p>[1] R. Montanari, A. Lanzutti, M. Richetta, J. Tursunbaev, E. Vaglio, A. Varone, C. Verona, Plasma Carburizing of Laser Powder Bed Fusion Manufactured 316 L Steel for Enhancing the Surface Hardness, (2022) 1–13.</p> <p>[2] E. Bolli, S. Kaciulis, A. Lanzutti, A. Mezzi, R. Montanari, A. Palombi, F. Sordetti, E. Vaglio, A. Varone, C. Verona, Surface characteristics and tribological behavior of 3D-printed 316 L steel after plasma assisted low temperature carburizing, Surf. Coatings Technol. 477 (2024). doi:10.1016/j.surfcoat.2023.130295.</p> <p>[3] A. Lanzutti, M. Magnan, E. Vaglio, G. Totis, M. Sortino, L. Fedrizzi, Study of the Effect of L-PBF Technique Temporal Evolution on Microstructure, Surface Texture, and Fatigue Performance of Ti gr. 23 Alloy, Metals (Basel). 13 (2023). doi:10.3390/met13071247.</p> <p>[4] E. Marin, M. Pressacco, S. Fusi, A. Lanzutti, S. Turchet, L. Fedrizzi, Characterization of grade 2 commercially pure Trabecular Titanium structures, Mater. Sci. Eng. C. 33 (2013). doi:10.1016/j.msec.2013.02.034.</p> <p>[5] A. Lanzutti, E. Marin, K. Tamura, T. Morita, M. Magnan, E. Vaglio, F. Andreatta, M. Sortino, G. Totis, L. Fedrizzi, High temperature study of the evolution of the tribolayer in additively manufactured AISI 316L steel, Addit. Manuf. 34 (2020) 101258. doi:10.1016/j.addma.2020.101258.</p> <p>[6] R.I. Revilla, B. Wouters, F. Andreatta, A. Lanzutti, L. Fedrizzi, I. De Graeve, EIS comparative study and critical Equivalent Electrical Circuit (EEC) analysis of the</p>





	<p>native oxide layer of additive manufactured and wrought 316L stainless steel, Corros. Sci. 167 (2020). doi:10.1016/j.corsci.2020.108480.</p> <p>[7] F. Andreatta, A. Lanzutti, E. Vaglio, G. Totis, M. Sortino, L. Fedrizzi, Corrosion behaviour of 316L stainless steel manufactured by selective laser melting, Mater. Corros. 70 (2019). doi:10.1002/maco.201910792.</p> <p>[8] E. Marin, R. Offoiach, A. Lanzutti, M. Regis, S. Fusi, L. Fedrizzi, Hybrid diffusive/PVD treatments to improve the tribological resistance of Ti-6Al-4V, Biomed. Mater. Eng. 24 (2014). doi:10.3233/BME-130845.</p>
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**Struttura dell'Università di Udine presso la quale verrà sviluppata l'attività di ricerca / Department or other structure of the University of Udine where research activities will be carried out:**

Dipartimento Politecnico di Ingegneria e Architettura (DPIA). / Polytechnic Department of Engineering and Architecture.

**Importo dell'assegno di ricerca (al lordo oneri carico assegnista) / Total grant gross for the research fellowship:**

€ 19.367,00

**Durata dell'assegno di ricerca / Duration of the research fellowship "assegno di ricerca":**

12 mesi / months

**Finanziamento / Financed by:**

La copertura finanziaria graverà sui fondi/progetti:

- risorse d'Ateneo: bando interno finanziamento assegni 2024 (D.R. n. 181/2024) - CUP: G23C24000370005;
- ricerca libera del professor Alex Lanzutti.

**Requisiti di ammissione / Minimum qualifications necessary:**

Possesso di un diploma di laurea vecchio ordinamento (ante decreto 3 novembre 1999 n. 509) o di laurea specialistica/magistrale (ex decreto 3 novembre 1999 n. 509 e decreto 22 ottobre 2004 n. 270) o titolo equivalente conseguito all'estero. / Possession of a University degree obtained before Decree n. 509 of 3 November 1999 or specialistic/Master's degree (post decree n. 509 of 3 November 1999 and decree n. 270 of 22 October 2004) or equivalent degree obtained abroad.

**Modalità di presentazione della documentazione oggetto di valutazione / Arrangements for the submission of documents:**

La modalità di presentazione della documentazione oggetto di valutazione è specificata all'art. 4 del bando. / The way of presenting the documentation under evaluation is specified in art. 4 of the present notice.

Ai fini valutativi, i candidati potranno presentare le pubblicazioni e ogni altro titolo ritenuto utile a comprovare la propria qualificazione in relazione al programma di ricerca descritto nell'Allegato A, nelle seguenti lingue: / For evaluation purposes, candidates may present publications and any other qualifications deemed useful to demonstrate their qualification in relation to the research program described in Attachment A, in the following languages:

- Italiano / Italian
- Inglese / English





**Procedura selettiva / Competition procedure:**

Valutazione per titoli e colloquio. / Evaluation of titles and oral exam.

I risultati della valutazione dei titoli saranno resi noti agli interessati nel corso del colloquio. / The evaluation of the qualifications will be disclosed to candidates during the interview.

Calendario del colloquio / Calendar of the oral exam	Modalità / Modality	In presenza / On site
	Data / Date	19 settembre / September 2024
	Ora / Time	9:00 / 9:00 am (Italian time)
	Luogo / Place	Studio del professor Alex Lanzutti presso il Dipartimento Politecnico di Ingegneria e Architettura (DPIA). / Office of professor Alex Lanzutti at the Polytechnic Department of Engineering and Architecture.

Per sostenere il colloquio i candidati devono esibire un valido documento di riconoscimento. / Candidates must come to the interview with a valid identity document.

Eventuali variazioni saranno rese note esclusivamente mediante pubblicazione all'albo ufficiale on line dell'Ateneo / Any change will be made public solely through publication on the University web site [http://web.uniud.it/ateneo/normativa/albo\\_ufficiale](http://web.uniud.it/ateneo/normativa/albo_ufficiale)

**Commissione giudicatrice / Examining Board:**

Nome e Cognome	Qualifica	SSD	Università
<b>Membri Effettivi / Permanent members</b>			
Alex Lanzutti	PA	IIND-03/C	Università degli Studi di Udine
Lorenzo Fedrizzi	PO	IMAT-01/A	Università degli Studi di Udine
Francesco Andreatta	PA	IMAT-01/A	Università degli Studi di Udine
<b>Membro Supplente / Temporary member</b>			
Stefano Maschio	PA	IMAT-01/A	Università degli Studi di Udine