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WIDESPREAD-05-2020 – Twinning-CSA

D3.4 Final report on staff exchanges (M18 - UniMi)

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DEC	Websites, patent fillings, videos, etc.
ETHICS	

Dissemination Level	
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CO	Confidential, only for members of the consortium (including the Commission Services)

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Table of Contents

1. List of Figures	4
2. List of Tables	4
3. Objectives.....	4
4. Short description of the host partners	4
5. Rescheduled calendar due to the covid pandemic.....	5
6. Short introduction of the young researchers of the University of Miskolc..	9
7. Future plans	11



1. LIST OF FIGURES

Figure 1.: The 2021. Calendar of the UMA ³	7
Figure 2.: The 2022. Calendar of the UMA ³	8
Figure 3.: The 2023. Calendar of the UMA ³	9

2. LIST OF TABLES

Table 1.: The Summary of the Staff Exchange Report.....	11
Table 2.: Events and the planned travelling UniMi colleagues.	11

3. OBJECTIVES

The concept of the short term staff exchange is to provide education, training and knowledge exchange to the young researchers of the UniMi. The topics that are given knowledge exchange in are mostly consists of powder metallurgy (aluminium based composites), additive manufacturing (Ti, and Mo based composite materials, advanced steel materials), these are further elaborated in detail in the partners profile and in the rescheduled event's description.

Due to the pandemic situation of the Covid-19, any event in the UMA³ project that were not planned to be taken place in an online event, needed to be postponed in 2021 (fortunately it only affected the SE1: staff exchange, other events were held online). Based on recent discussion with the partners it was decided that a "mitigation plan" will take place in order to advance our progress more closely matched with the original schedule. This affects currently the past SE1 and the upcoming summer-autumn activities. Moreover UniMi will also pay a great attention to the fact that the colleagues who will travel to the partner institutes, would need to be eligible for EU green pass, so they could not only access the country of the partner institutes, but also their buldings: laboratories, office buildings, etc.

- Short description of the host partners
- Rescheduled calendar due to the covid pandemic
- Short introduction of the young researchers of the University of Miskolc
- Future plans

4. SHORT DESCRIPTION OF THE HOST PARTNERS

Fraunhofer-IFAM

Fraunhofer IFAM is divided in two departments. The department "Adhesive Bonding Technology and Surfaces" performs research on multifunctional coatings, paints, polymer chemistry, nanoparticle applications, and plasma and lacquer technology as well as on adhesive bonding and surface analytics. The department "Shaping and Functional Materials" is working in the areas of research and development of powder technology, additive manufacturing, casting technology, light weight construction, micro production technology, functional printing and



nanopowder technology. Its Powder Technology Department has been active in the field of powder metallurgy processes like powder injection moulding (PIM) for more than two decades and has the largest and best-equipped working group outside industry in this field. Besides, IFAM has performed research and development in metal additive manufacturing since the 1990s, focusing today on the laser beam melting (LBM) powder bed fusion as well as binder jetting processes. The work of the institute ranges from fundamental research to the introduction of new products to the market. Industrial fields of application are in plant engineering, micro-assembly, packaging, electronics and transportation.

LTSM

Laboratory of Technology and Strength of Materials (LTSM) is part of the Department of Mechanical Engineering & Aeronautics of University of Patras. The research activities of LTSM are in the fields of Materials Science, Strength of Materials and Structural Analysis. During the last decade more than 200 publications were made by LTSM members, while in the last two decades, more than 20 doctoral theses have been completed. In the last 25 years, LTSM has gathered significant experience in the field of advanced aerospace materials by working on the design, experimental characterization and numerical modelling of materials and structural parts. Moreover, in the last 5 years, LTSM has expanded its activities to nanomaterials, such as graphene, carbon nanotubes and multifunctional nanocomposites.

UniBo

The University of Bologna is represented in the UMA³ by the Interdepartmental Center for Industrial Research on Aerospace (CIRI Aeronautica, in brief). Established in 2010 within the project Emilia-Romagna Regional Technopole Network, CIRI Aeronautica develops industrial research projects in the Hi-Tech sectors with particular reference to the areas of Aeronautics and Space, exploiting the synergies between the expertise available in the Departments of the University of Bologna to promote basic and industrial research and technology transfer. CIRI Aeronautica currently consists of about 30 research staff, including UniBo faculty members and full-time researchers. It gathers knowledge, competences and skills in mechanical engineering and aeronautics, lightweight structures, new composite and metallic materials and processing in a single centre equipped with advanced infrastructures and research labs.

5. RESCHEDULED CALENDAR DUE TO THE COVID PANDEMIC

Below the detailed plan of the forwarding of the UMA³ personal events can be seen. Since the Covid-19 pandemic could any time greatly influence the advance of the UMA³ project, the plans also account for the fact that restrictions and severe health hazards could impose obstacles to the availability to hold these events personally and in the given schedule. This is why all close events (up until the autumn of 2022.) are also prepared with the mitigation plan, so the implementation of the UMA³ project could be carried out.



Fraunhofer-IFAM (SE1 and SS1)

In Germany the local government decided that the Covid-related restrictions will be reduced in March, which will need to be transferred and implemented by the Fraunhofer Institute, therefore it can be expected that the restrictions will be lifted by April. The staff exchange (SE1) is planned to take place in October of 2022 (two colleagues of UniMi could visit IFAM for four weeks), if Covid gets more severe and travel is restricted, then in 2023. Regarding the summer school of (SS1) is planned to take place at the end of May or the beginning of June (2022.), since this way it would not coincide with the summer school of LTSM (SS2), if the Covid-situation is not favourable in May-June, then it will be held in September or October of 2022, in the case if the restrictions don't allow personal attendance, then the postponed SS1 summer school will be held online. Regarding the SE2 event, which would have taken place in 2022. April 11-15. since the SE1 and SS1 was scheduled before SE2 (which events are now in focus), so it will be organized after these events have been carried out.

LTSM (SS2)

In Greece the government will reduce the Covid restrictions in March. Regarding the summer school (SS2), the end of September (2022.) is planned, since it would allow more researchers and staff to attend from LTSM (before the start of the academic semester) and would not coincide with the SS1 of Fraunhofer. If the pandemic situation results in the necessary delay of the event, then it is decided to be held at the second half of January (2023.). In this way, if the SS1 summer school also needs to be postponed, there would be a favourable 3-4 month difference between the two events.

UniBo (SE3)

In Italy the current restrictions will be lifted of quarantine necessity of the incoming people on March 1st of 2022. However there will be restrictions regarding accessing University Labs, where Green Pass ownership of the arriving UniMi colleagues will be needed, therefore it's a key aspect that the travelling UniMi personell will need to have (and has) vaccination that is accepted in Italy. Regarding SE3 (2022) UniBo can host UniMi colleagues and researchers in Forlí or Bologna from the end of August up to the autumn of 2022. If the Covid situation would turn more severe, so travelling in any way would not be feasible, the staff exchange would take place in the spring of 2023.



2021

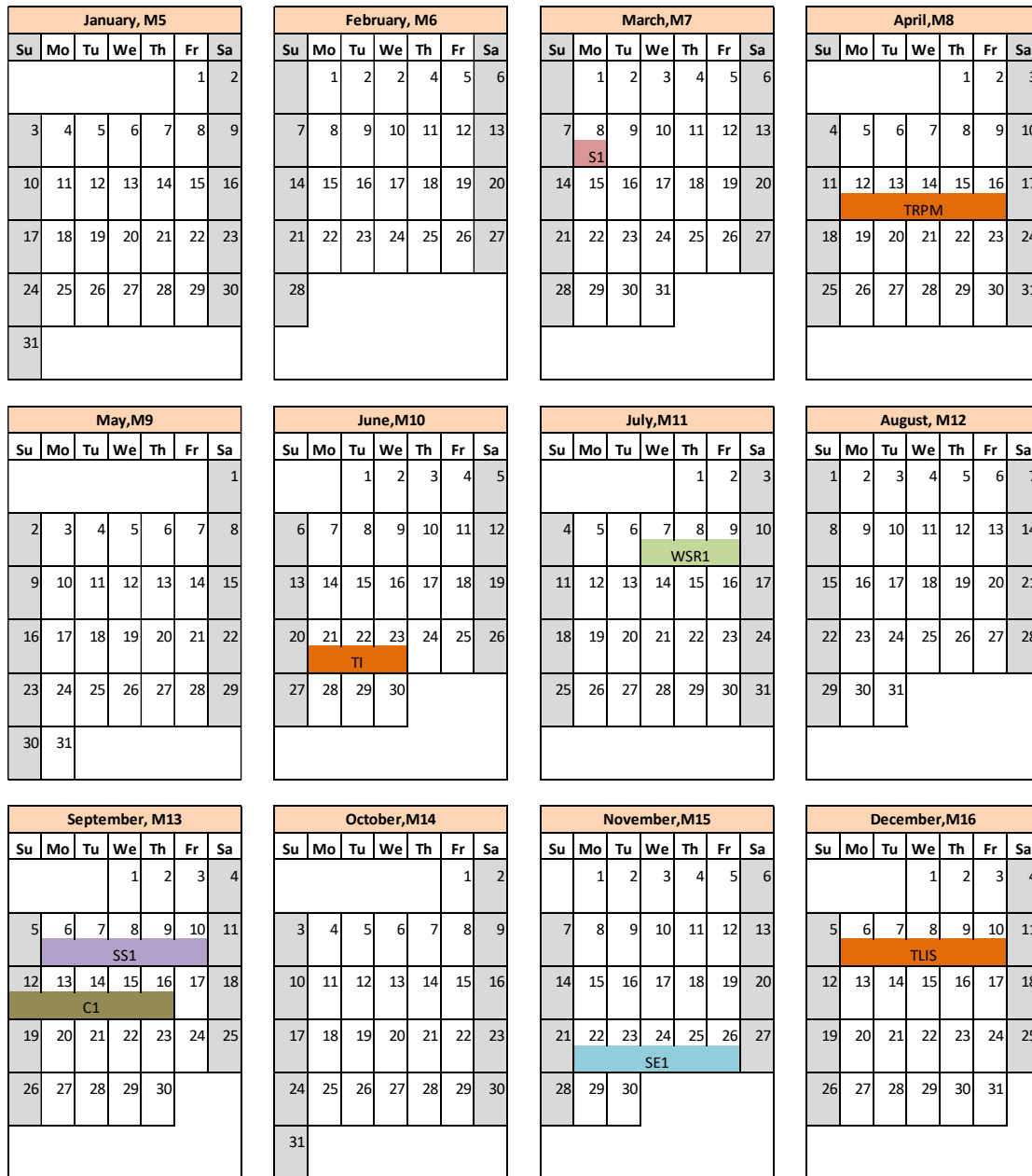


Figure 1.: The 2021. Calendar of the UMA³.

SS1	Summer School, (Task 3.3, Place: Germany, Leader: Unibo, Fraunhofer) POSTPONED
SE1	Staff Exchange (Task: 3,4, Place: Germany, Leader: UniMi) POSTPONED
TLIS	Loc. Indiv. Sci. training (Task 3.5.A, Place: Hungary, Leader: UniMi) ONLINE
TI	Training in Innovation (Task 3.5.B, Place: Spain, Leader: Fraunhofer) ONLINE
TRPM	Training in Research and Project Management and Administration (Task 3.6, Place: Leon, Leader: IcamCyl) ONLINE
WSR1	International Strategically recommendation wokshop(Task: 4.1.A, Place: Leon, Leader: Icamcyl) ONLINE
S1	Seminars, (Task 4.1.B, Place: webinar, Leader: Icamcyl) ONLINE
C1	Participation in Internation Conferences (Task: 4.2, Place: GRAZ, Leader: Icamcyl) ONLINE



2022

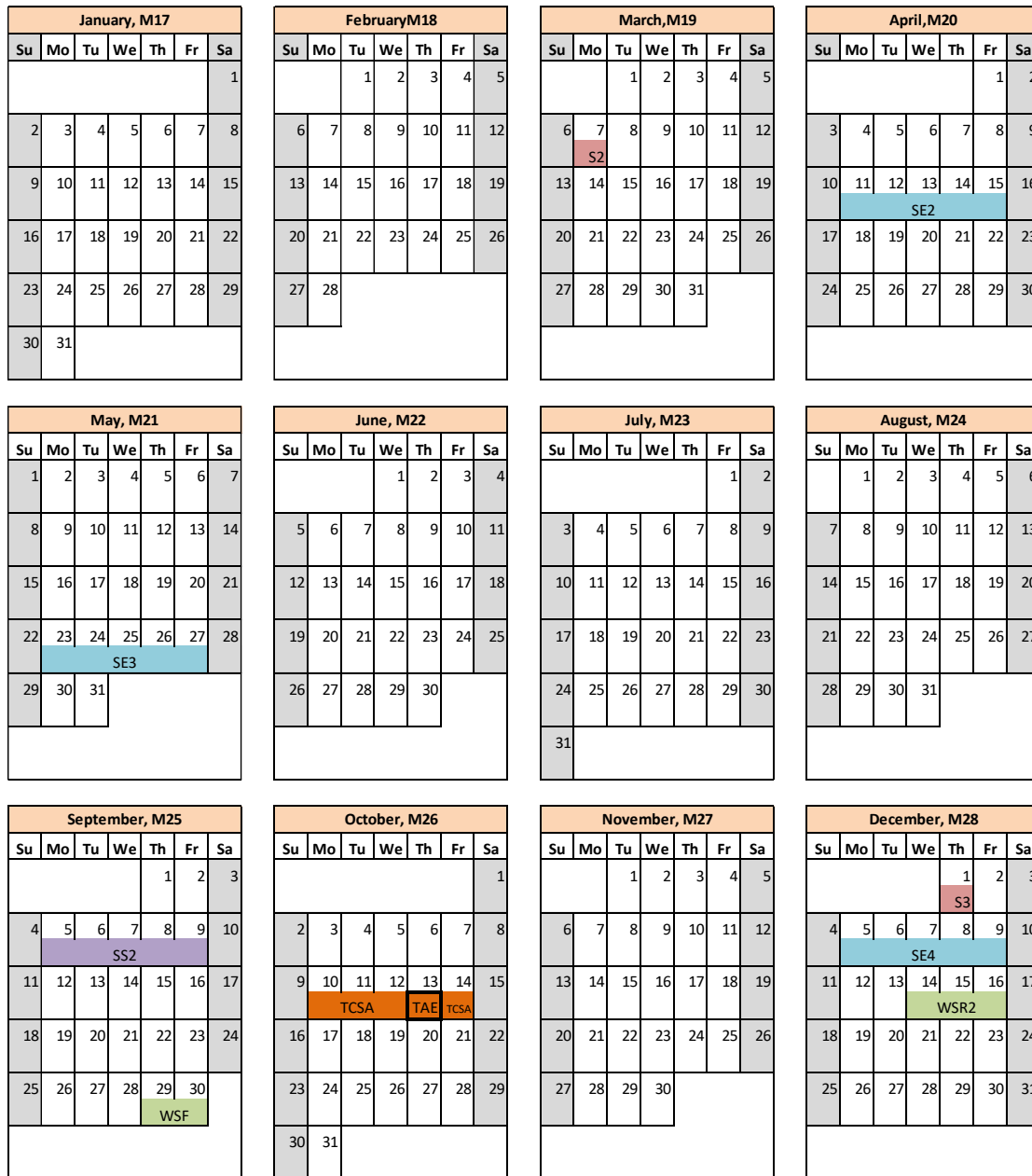


Figure 2.: The 2022. Calendar of the UMA³.

SS2	Summer School, (Task 3.3, Place: Greece, Leader: LTSM)
SE2	Staff Exchange (Task: 3,4, Place: Germany, Leader: UniMi)
SE3	Staff Exchange (Task: 3,4, Place: Bologna, Leader: UniMi)
SE4	Staff Exchange (Task: 3,4, Place: Leon, Leader: UniMi)
TCSA	Complementary/transerable Skills Advanced Training (Task 3.5.C, Place: Germany, Leader: Altran, UniBo)
TAE	Additional Events (Task 3.5.D, Place: Germany, Leader: IcamCyl, UniBo)
WSR2	International Strategically recommendation workshop (Task: 4.1.A, Place: Greece, Leader: LTSM)
S2	Seminars, (Task 4.1.B, Place: webinar, Leader: Icamcyl)
S3	Seminars, (Task 4.1.B, Place: webinar, Leader: Icamcyl)
WSF	Strategic Foresight Workshop (Task: 4.1.C, Place: webinar/ Leon, Leader: Icamcyl)



2023

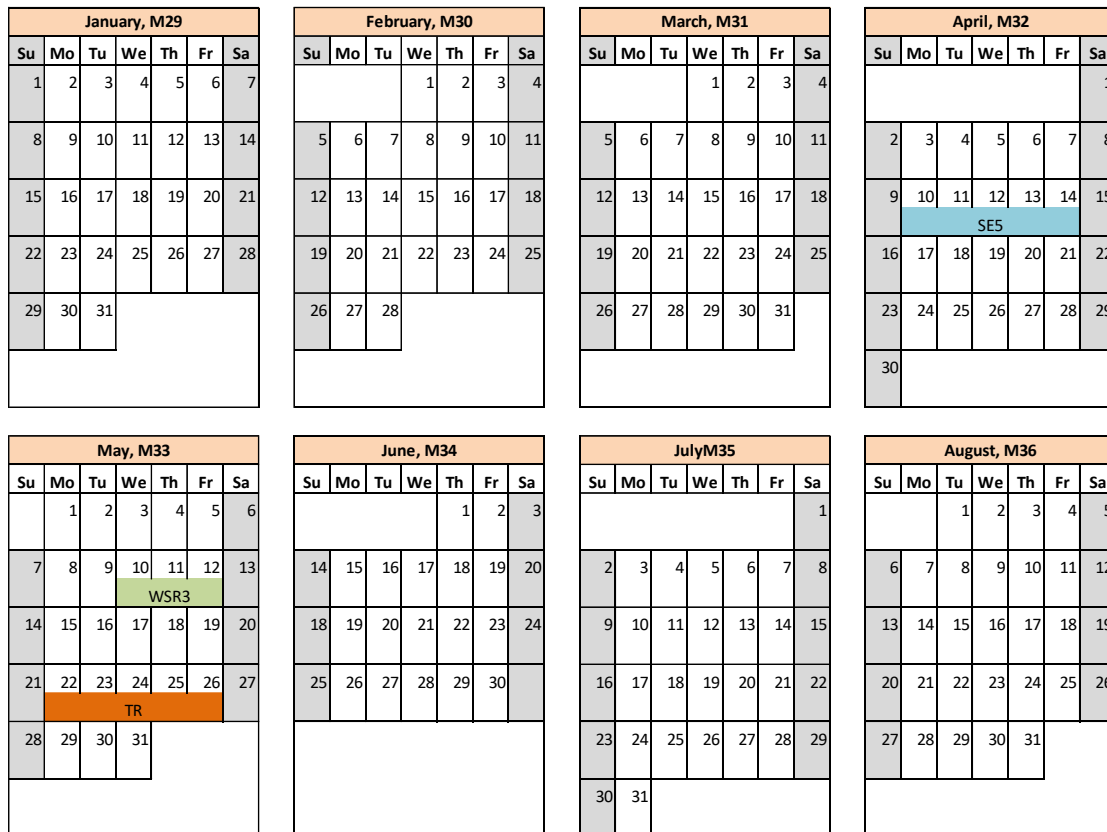


Figure 3.: The 2023. Calendar of the UMA³.

SE5	Staff Exchange (Task: 3,4, Place: Germany, Leader: UniMi)
TR	Training by research (Task 3.2, Palce: Bologna, Leader: UniBo)
WSR2	International Stregetically recommendation wokshop(Task: 4.1.A, Place: Bologna, Leader: UniBo)

6. SHORT INTRODUCTION OF THE YOUNG RESEARCHERS OF THE UNIVERSITY OF MISKOLC

In this section, as an added, non-exhaustive list, the colleagues of the UniMi shortly introduce themshelves. In this way the link between their associated fields, scientific interests, and the expertise of the partners (detailed above) can be ascertained.

Máté Czagány – PhD student

In the course of my research first I was studying the wettability of Cu braze material, Sn-Bi, and Sn-Bi-Zn solder alloys on steel surfaces by measuring the contact angles, and studying the microstructure of the joints. After that, I started to develop electroless Ni-P binary, and composite coatings. I modelled the mechanism of the layer formation which was based on the segregation of the P atoms onto the grain-boundary of the Ni nanocrystals. In the case of the Ni-P-TiC nano-composite coatings, I investigated the electrokinetical stability of the Ni-P baths, cotaining TiC nanoparticles. During the PhD education, my research was focused on developing Cu-based nano-multilayers (Cu/Al-O-N), deposited by PVD method. The aim of the research was to study the thermal behaviour of the multilayer during heating, and to investigate the nano-effect of melting point depression (MPD) owing to the nano-



structure of the Cu layers. Today I am working on to prepare nano-porous activated carbon (AC) forms, synthesized from different agricultural waste materials. The AC is a base material of the electrodes of supercapacitors. I am working on to study the electrochemical properties of these carbon forms, to evaluate their performance as supercapacitors.

Zoltán Dávid Gyökér – PhD student

My research topic is about the development of lead-free solder composites. The aim of my research topic is to produce solder composites that have higher mechanical strength, better wettability than the currently used solder materials. To create these solder composites SAC (Sn-Ag-Cu) solders and SiC (in micron and nanometer size) ceramic particles were used. To solve the bad wettability between the solder and the ceramic particles, electroless metal coating was used (Ni-P, and Cu). I use different surface activation methods and change the coating parameters. The results are investigated by SEM, image analysis, specific surface measurement. The lead-free solder composite samples will be created by reflow soldering. I tests are undergoing about the mechanical properties and the microstructure.

Dr. Tamás Mikó – Senior Research Fellow

I have been working in the area of powder metallurgy with special type of composites and alloys, such as Ti-TiB, W-Cu, Ti-Al, W-Al, amorphous master alloys and other steel alloys. I have thorough experience in also the manufacturing technology of each powder metallurgical steps (planetary ball milling, cold uniaxial compression, hot uniaxial compression, sintering), since I have been the leading character of the development of these tools (e.g. just recently finished a tool that aids in producing tensile test specimens using powder metallurgy) for my institute. I have just finished my doctoral work in 2016, in the area of mechanical materials characterization. My experiences in material testing aids me greatly in the future powder metallurgical researches. Moreover, I have always been a naturally curious person, so I am interested to learn more about this field.

Dániel Pethő – PhD student

I believe, I fit well into the scope of the project, since the topic of my doctoral work is the development of Mo-Cu alloys reinforced with Al₂O₃ particles. These materials are also used in the aerospace industry, moreover the production method of my research materials is using the area of powder metallurgy, which is also closely related to the project. Moreover, I have gained relevant experiences in the area of powder metallurgy in a previous EU funded research (ICARUS, H2020, Project No.: 713514) working with alloys containing elements with positive enthalpy of mixing (which is what induced my research of Mo-Cu based composites). I have enjoyed my work as a researcher greatly and I am keen on learning more about the area of MMCs (Metal Matrix Composites) and powder metallurgy.

Mohamed Quasim Kareem Yasi – PhD student

Keeping the direction of a subject is not only a matter of choice, but also of luck. I always try to keep my fields of study close together (i.e., bachelor's and master's). I started with recycling aluminum and strengthened it with recycled destroyed class, iron with fullerene, then aluminum with graphite by casting. In my PhD thesis, I am working on the production of 17-4PH stainless steel parts using two different techniques: conventional powder metallurgy (CPM) and 3D printing (Selective Laser Melting, SLM). The metallurgical behavior is completely different because in the



case of CPM there is no fusion (melting), while in the SLM process the powders must be melted to produce a 17-4PH part. More investigations will be performed to compare the physical and mechanical properties of these parts (CPM and SLM 17-4PH parts). These investigations will be performed by X-ray analysis, FIB, SEM and CT. The comparison of mechanical properties will be done by tensile tests and impact tests. In the future, my PhD work could also include light metals such as aluminum and reinforcement with Ti.

7. FUTURE PLANS

The Covid pandemic clearly posed a significant hinderance to the progress of the summer schools and staff exchanges of the UMA³. Regardless of this, due to the ease that some restrictions are going to be lifted, moreover generally vaccination and tests are available, the on-site events are going to progress as described above, with the clear ambition that as much as possible, should be held personally and according to the updated schedule. Moreover, as it can be seen, the profile of the hosting partners and the profile of the introduced colleagues of the UniMi match well, the partners possess considerable scientific and technical knowledge to share, that aids in the successful implementation of the UMA³ twinning action as in the increased knowledge of the UniMi researchers. Below in the Table 1-Table 2., the summary of this report can be seen.

Table 1.: The Summary of the Staff Exchange Report.

Event	Host	Original date	Rescheduled date	Mitigation plan
Summer school SS1	Fraunhofer-IFAM	2021.09.06-10.	End of May, beginning of June (2022.)	Sept.-Oct. of 2022.
Staff exchange SE1	Fraunhofer-IFAM	2021.11.22-26.	October of 2022.	Spring of 2023.
Summer school SS2	LTSM	2022.09.05-09.	End of Sept. (2022.)	Second half of Jan. 2023.
Staff exchange SE2	Fraunhofer-IFAM	2022.04.11-15.	Nov.-Dec. of 2022	Spring of 2023.
Staff exchange SE3	UniBo	2022.05.23-27.	August-autumn of 2022.	Spring of 2023.

Table 2.: Events and the planned travelling UniMi colleagues.

Event	Planned travelling UniMi colleagues
SS1	2 PhD + 2 MSc students
SE1	Mohamed Quasim Kareem Yasi + 1 other PhD student
SS2	Máté Czagány, Zoltán Dávid Gyökér + 2 MSc students
SE3	Dr. Tamás Mikó, Dániel Pethő