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RESQTOOL

NEWSLETTER

COORDINATOR'S FOREWORD



Kenan Boz (EPMA)
- RESQTOOL Coordinator

Dear RESQTOOL Followers,

Welcome to the first issue of our biannual newsletter of the RESQTOOL Project. The objective of the newsletter is not only to provide a summary of the activities and results of the project, but also to address a variety of topics related to these activities such as those concerning recycling of Hard Materials, Critical Raw Materials (CRM), Sustainability, and business-innovation opportunities. The name of the project comes from the abbreviation of its full title of "Recycling of High Quality CRM Resources from Machining Tools for Re-use Applications", which at the same time means to "rescue" the critical raw materials consumed in EU such as Tungsten or Cobalt from being either downcycled or totally lost. RESQTOOL is funded by the EU under the call HORIZON-CL4-2023-RESILIENCE-01-05 of the Horizon Europe programme. The total budget of the project is 8.8 M€ and its duration is 48 months. Coordinated by the European Powder Metallurgy Association (EPMA), the RESQTOOL project became reality in December 2023 with 12 partners from 10 EU/EEA countries (Belgium, Finland, France, Germany, Ireland, Italy, Liechtenstein, Luxembourg, Poland, Spain) covering the entire value chain of hardmetals (HM).

In this context, and working towards a more sustainable and resilient EU by building innovative value chains from raw materials to sustainable products, RESQTOOL proposes a unique technological solution based on the recycling of HM for re-use, thus contributing to an efficient use of resources while promoting the use of critical raw materials in line with the strategies outlined in the European Green Deal and in the EU Action Plans on Critical Raw Materials and on Circular Economy.

As you can see, we are going to cover and address very interesting topics that are closely linked to today's societal challenges. The project consortium thanks you in advance for your interest in the work that we will be developing, and of which you will also be an important part.

I hope you enjoy reading our first newsletter and feel free to share it with anyone you think might be equally interested in these topics. Also, we are available for any further information, so please don't hesitate to contact us if you have any questions.

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WHAT IS RESQTOOL?

Hardmetals (HM) or cemented carbides are composite materials with one or more hard but brittle constitutive phases and a ductile metal binder that gives toughness without impairing the high hardness of carbide components. The metallic carbides are usually mainly tungsten carbide (WC), and additionally Titanium Carbide (TiC) or Tantalum Carbide (TaC). The binder metal used as the matrix usually contains mainly Cobalt (Co), Nickel (Ni) and Iron (Fe). HM form today the backbone of the tool manufacturing industry, as they show a wide range of combinations of high hardness and toughness, making them suitable for many diverse wear applications as in Figure 1. Current state-of-the art and limitations:

The value chain of HM (Figure 2) is a long path from product design to end-user. Raw material supply is critical because it is mainly sourced outside of the EU zone, and the production processes are extremely energy dependent with a high level of carbon footprint. Some recycling paths are available, but the usual way is using the End-of-Life (EoL) products as an alloying element in tool steel production or hard-facing. The latter is the method of deposition of crushed and milled HM scrap on a worn or new component surface that is subject to wear in service. Both paths are downcycling where the recycled material is of lower quality and functionality.



Figure 1: Hardmetal applications.

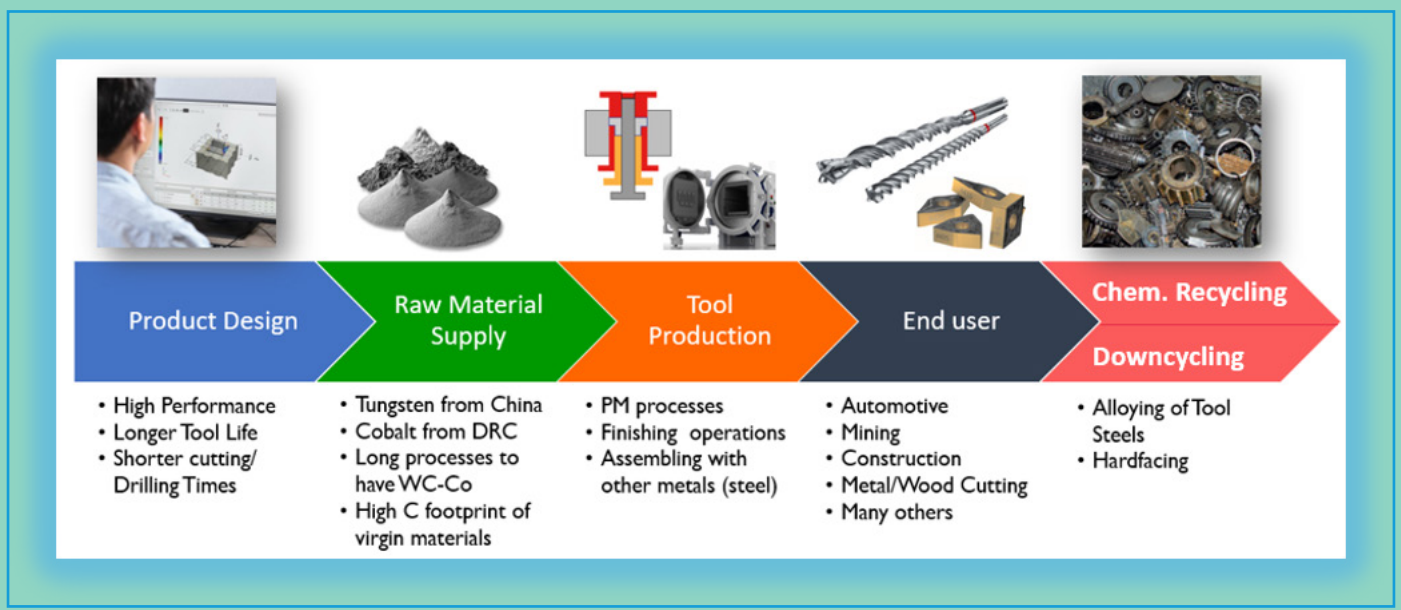


Figure 2: The state-of-the-art value chain of Hardmetals.

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The RESQTOOL Solution

RESQTOOL brings in a holistic solution (Figure 3) to HM recycling to cover all possible type of scraps and to extract all possible materials used in HM production such as W, WC, Co, and other CRM (Ti, V, Ta, Nb). On its way to succeed in this objective, RESQTOOL implements a zero-waste approach in compliance with the 'do no significant harm' principle as per article 17 of Taxonomy Regulation (EU) No 2020/852. As a first step, RESQTOOL will identify HM scrap sources by their initial industrial uses. This will serve to identify a certain recycling code for each group to be used in determining their recycling scheme. Then, sampling protocols and methodologies to quantify CRM resources in specific products will be setup and used to collect HM scrap samples from the entire EU zone. Collected materials will be investigated to determine the size and shape distribution, elemental composition, origin, mass, and other physical parameters important for its segregation and recycling. Every group will be forwarded to a certain recycling scheme depending on the material properties and other aspects of the used components.

These recycled materials will be used to produce tools with quality equivalent to the original, measuring their performance as a validation route: this will include a thorough evaluation of the environmental impact of the new supply chain, in order to demonstrate the improved sustainability over the present state-of-the-art.



Figure 3: Proposed RESQTOOL hardmetals process concept as a circular business model.

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NEWS FROM RESQTOOL

ACTIVITY FROM MONTH 01 TO MONTH 08

In the first few months from its start, RESQTOOL already carried out many activities, mostly creating the frame for the rest of its endeavours in the next years. For those who are not familiar with the formalities of EU projects, and namely of Horizon Europe funded projects, the work done is normally reported by the Consortia to the funding agency by writing reports that have the common name of "Deliverable". Each Deliverable is prepared by the responsible partners and submitted electronically to the EU Funding & Tenders portal, where it is later evaluated for approval by the experts nominated and the relevant Project Officer. From December 2023, when RESQTOOL started, to July 2024, that is month 8 of the project, several deliverables were prepared and submitted, all within the agreed deadlines, demonstrating that the activity is correctly flowing as expected. We will summarise here the content of these deliverable (please note that the content is in many cases confidential, so we cannot give you details).

D1.1 Report of Machine-readable recycling codes

We analysed the state of the art of tool coding and took initial decision on how our coding should be, with the objective of transforming it into a standard at the end of RESQTOOL.

D2.1 HM Scrap sources identification report

We made a detailed analysis of HM scrap profile in Europe to help grouping of HM scrap sources by the industry type, size and shape, elemental composition, origin, mass, and other physical parameters important for segregation and recycling.

D7.1 Creation of the project website, graphical identity and other online tools

At the beginning, we quickly created the graphical identity of RESQTOOL and the tools (website, social media accounts, etc.) needed for communication and dissemination.

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D1.2-D1.5 Business case part descriptions

These are the latest reports on the business case selections made to demonstrate the capability of the project's solutions. These are the components that will later be produced with recycled material, and whose properties will be compared to those of the components produced with virgin material. The parts will be: a metal/wood cutting tool, a rock/concrete drilling tool, a sand blasting nozzle and a cold forming tool. Each business case is specific to one of the end-user partners.

D2.2 Report on collected scrap samples around Europe

Based on the results shown in D2.1, HM scrap samples have been collected from 13 different sources from all identified industries and different areas of the EU, sorted according to the state-of-the-art sorting processes, and for each form, analysed with the correct standard procedure, including X-Ray fluorescence (XRF) for larger parts.

D7.2 Dissemination & Communication Plan

This is one of the standard documents required and is a thorough plan on how Dissemination and Communication will be carried out during the project, including publications, participation to events with presentations and/or booths, newsletters, etcetera: but also training, and clustering with similar projects and initiatives for synergy and efficiency.

D9.1 Project management handbook defining administrative and financial operations

This is going to be used as a handbook for consortium partners, where they can quickly retrieve all info necessary for undertaking their activities, with details on the management structure, data sharing and communication among partners, all work packages, tasks, deliverables and milestones, and the risks already listed.

D9.2 Quality Assurance & Risk Management Plan

Another document that gathers the project's policies to assure the quality of the work, and a full description of the risk management procedures imagined.

D9.3 Project Data Management Plan – First Edition

This was another "contractual" document, focusing on data management, namely to clarify how the project will follow the F.A.I.R. concept (findable, accessible, interoperable, reusable) for data management that translates into Open Access management of all public data and safe management of confidential ones.

As you can see, lots of information had to be conveyed already; this led to intense exchange between the partners and is very valuable to put all on the same page and start the technical side of the activity with the right steps. In the next editions of the newsletter, we will be able to show you some actual achievement, already!

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INTERNAL MEETINGS

Kick-Off Meeting in Chantilly (France)

On 13th December 2023, we kicked off our project with a consortium meeting held at the premises of the coordinator EPMA, in Chantilly, France.

All partners, which are industrial organisations, research centres as well as universities, took part and this ensured straight collaboration and strategies alignment for the successful implementation of the project. The meeting was held in presence of the EU Project Officer and the whole programme was explained by the Coordinator and all work package leaders, and reviewed by the members in order to decide the activities for the following months, and take some key decisions.

On the occasion, the consortium had also a convivial moment in the meeting dinner in the restaurant "La Prego" in Chantilly!



Figure 4 Group picture of the consortium partners at the kick-off meeting in Chantilly, on 13th December 2023.



Figure 5 : The meeting dinner held in Chantilly on 12th December 2023.



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Meeting in Domodossola (Italy)

After about 6 months of activity, we had the chance of meeting all together again in Domodossola, Italy, not distant from the premises of our partner FILMS (Figure 6). The meeting was held at the Cappella Mellerio (Figure 7) on 28th and 29th May and encompassed a full review of the activity undertaken in the various work packages, and discussions on how to carry on the tasks in the next six months and more. All partners were represented (and for some a remote connection was available, see Figure 8), and as usual a project dinner on the night of the 28th was included. The next general project meeting will take place in January 2025 in San Sebastiàn, Spain.



Figure 6 : Group picture taken in Domodossola at the second plenary meeting of RESQTOOL.



Figure 7 : The second RESQTOOL meeting held in the Cappella Mellerio, in Domodossola (Italy).

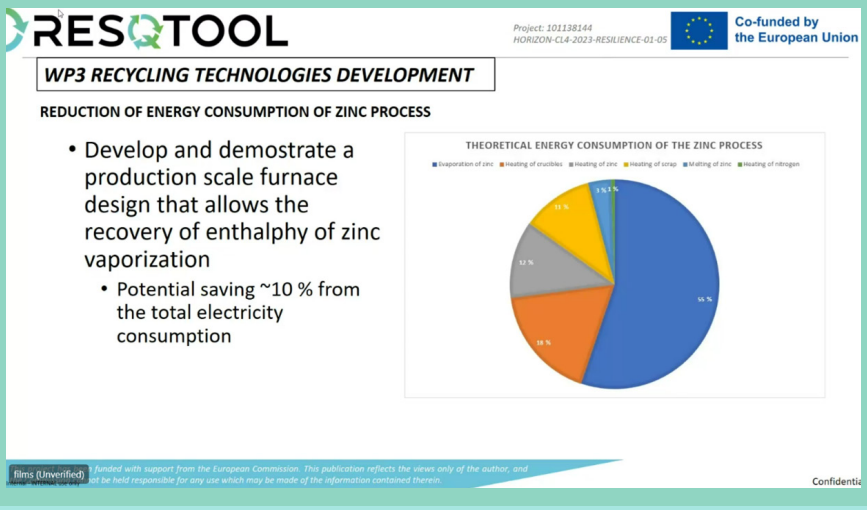


Figure 8 : The meeting was hybrid and some participants could take part online.

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TECHNICAL SHORTS

In this section consortium partners will give you regularly some technical info that you can use as a start to dive deeper into some important topics related to the RESQTOOL project. In this issue, we begin with a description of the processes that we plan to use during the project to recycle the hardmetal scrap. In TS01 our partner TIKOMET will give you details on the Zinc Process, whereas in TS02 our partner UNICA will explain how they can use acids obtained from agro-industrial residues to leach out W and Co.

TS01: THE ZINC PROCESS

History

It is said that Edward Moore Trent of Powderloys Limited, Coventry, observed in 1944 that cemented carbide drawing dies, made of WC and Co, were strongly attacked by zinc metal at elevated temperatures during drawing of brass wire (a copper/zinc alloy). Based on this observation, he filed a patent with the idea to treat cemented carbide parts with liquid zinc (US patent 2,407,752/1946) – Process of Separating Hard Constituents froum Sintered Hard metals) for the recovery of useable WC powder. As the cemented carbide parts bloated during the zinc-treatment, the reaction mass could be easily disintegrated. A subsequent acid leach dissolved the zinc/cobalt phases, leaving behind the valuable WC powder. Today, this process would be classified as a semi-direct recycling method, as only WC remained intact. No industrial use of this patent is reported.

In 1971 the idea of a Zn-treatment of cemented carbides was taken up by Paul Barnard (US Patent 3,595,484) who proposed to substitute the acid leach as described above by vacuum distillation process of zinc (boiling point 907 °C; at atmospheric pressure). In this case, both WC and Co remained as a final powder product. This second part of the treatment rendered the breakthrough of the Zn-process for industrial implementation. Basically, the treatment today still follows the guidelines of the Barnard patent, but significant developments in engineering were made for further improving the economy of the process.

Process

Carefully sorted and cleaned cemented carbide scrap is exposed to liquid Zn and Zn-vapour in graphite crucibles under argon or nitrogen at processing temperature between 600 °C and 900 °C (furnace temperatures of 800 °C to 1050 °C) for several hours, depending on scrap composition, size of parts, WC grain size, etc (Figure 9). Coatings and solders must be thoroughly removed from the cemented carbide parts prior to processing, as otherwise they will be present as contaminations in the recycled material and finally the ready-to-press (RTP) powder. Liquid zinc reacts with the binder (Co-, Ni- or Fe based) to form intermetallic phases which lead to volume expansion of the binder and bloats the

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scrap parts. After vacuum distillation of zinc, the material is porous and friable and can be readily disintegrated (Figure 10). The condensed zinc can be re-used. The reclaimed carbide/material sponge contains less than 50 ppm Zn (Figure 11).

Distillation of zinc starts at atmospheric pressure at temperatures above the boiling point of zinc (furnace temperatures of 1000 °C to 1050 °C), and the pressure is gradually reduced to a final pressure of 10-2 mbar, which takes another few hours. The cooled-down material is crushed, ball-milled, and screened to <200 mesh. The top screen is recycled in the next batch. [2]

The chemical composition of the final product is almost identical to the original, with the following exceptions:

- Pick-up of the approximately 0.1 % Fe (during the milling operations)
- Depletion in carbon by 0.12 – 0.15 %

The energy consumption is approximately 4 kWh/kg, which compares favourably to virgin WC produced via the chemical route (12 kWh/kg) [1]. Compared to the features of indirect conversion, the cost of zinc reclamation is reduced by 20 – 30 % for WC-Co grades and by 30 – 35 % for WC-TiC-Ta(Nb)C-Co grades [2].

The Zn-process can be applied for all currently available cemented carbides grades, such as Co-, Ni-, or Fe-based cemented carbides. In principle, it also works for cermet materials (Ti(C,N)-based cemented carbides), as well as tungsten heavy metal or tungsten copper parts [3], but is not yet applied on an industrial scale.

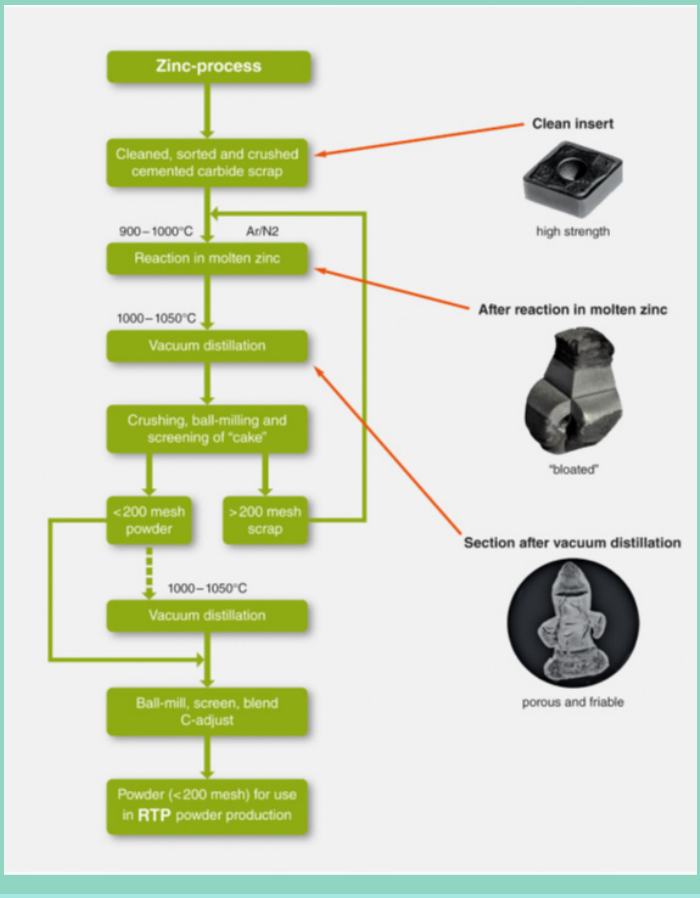


Figure 9 : The zinc-process [2]. Sorted and cleaned cemented carbide scrap is converted into a friable powder with the same composition as the scrap (direct recycling). Coated scrap has to be de-coated and solders have to be removed prior to processing. RTP signifies ready-to-press.

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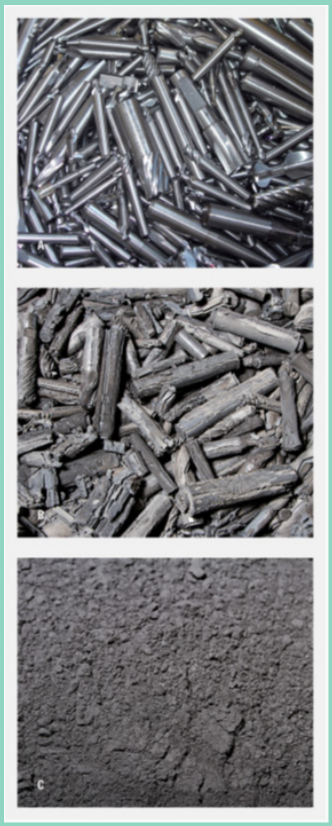


Figure 10 : Changes in morphology during the Zn-process. Sorted cemented carbide round tool scrap as input material for Zn-recycling (A). Round tool scrap after reaction with molten zinc and vacuum distillation (B). Final Zn-reclaim powder after ball milling, screening and carbon adjustment, ready to use for RTP (ready-to-press) powder production (C). Courtesy of CERATIZIT S.A.

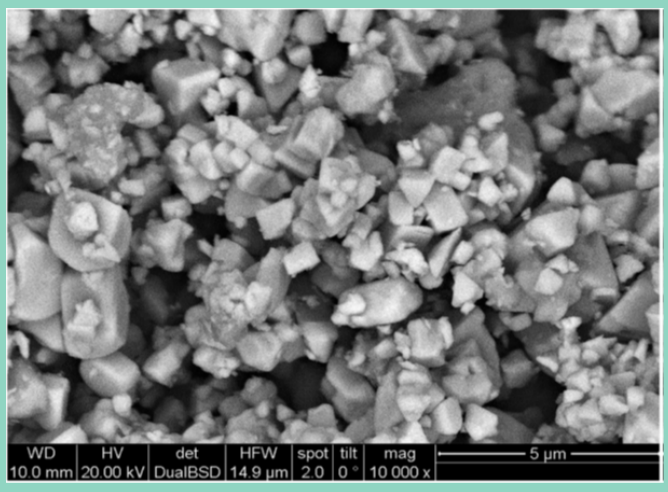


Figure 11 : Scanning electron microscopical image of a tungsten carbide (light grey particles), cobalt (darker grey areas) zinc reclaimed grade powder. Courtesy of Prof. Schubert/TU Wien.

Limits

The use of Zn-reclaim for recycling of cemented carbides is currently limited for a series of reasons. First of all, as the quality of the scrap is the most important prerequisite for a successful processing of the scrap, it is also a limiting factor in practice. Any insufficient sorting will directly affect the quality of the RTP powder and the subsequently sintered cemented carbide part. This implies that optimised collection and sorting technologies are becoming crucially important for increasing the amount of upcoming shares in direct recycling; although Zn-reclaim renders the most economic recycling technique for cemented carbides. This challenge has to be seen from today's strategies of extended use of alternative binder grades (CoNiCr-grades, FeNiCo-grades) or composite materials (parts made from two or even more different grades) in application, which pose a new problem in scrap identification. The use of a standardised bar code identifiability of individual grades (brought up during part manufacturing) might contribute in the future to a more efficient and reliable automatic sorting.

Zn-reclaim is also limited by the size of the parts, although unreacted parts can be recycled to a new charge. Therefore, large parts have to be disintegrated into smaller parts, prior to processing (if at all possible). Further, high-binder grades (up to 30% binder) are not optimal candidates for this kind of processing, as significant sintering of the binder can occur during the Zn-treatment.

Last, but not least, repeated recycling through Zn-processing will enrich certain impurities, such as iron (picked up during ball milling) or other elements which are introduced by inaccurate sorting or insufficient separations of coatings. Thus, it is easy to understand that only a certain percentage of cemented carbide recycling will be possible by the Zn-process, and the contribution of chemically recycled scrap or the use of primary raw materials are necessary to keep trace elements below the required threshold limit for production of high-quality cemented carbides.

Today, about a third of cemented carbide hard scrap is recycled by the Zn-process in Europe and the US [4], and about two thirds through chemical recycling. The total tonnage of available hard scrap for Zn-treatment will certainly increase in future due to market increases and improved material collection strategies.

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TS02: HARDMETALS AS URBAN MINES OF CRITICAL RAW MATERIALS TOWARDS ZERO WASTE, AND CHEMICAL RECYCLING WITH ORGANIC ACIDS FROM AGRO-INDUSTRIAL RESIDUES



Figure 12 : Selection of different types of hard and soft scraps. a) and b) examples of end-of-life HM tools; c) WC-based waste powders; d) HM manufacturing sludge. Sourced by ref. [7].

The high and increasing demand for Co and W for hardmetals (HMs) production (77.5 kt of W [5] and 9.35 kt of Co [6], in 2022) coupled with their growing criticality trend, stimulate the HM manufacturing chain to internally enhance their own scraps as a valued source of secondary raw materials. The good recycling practice still in place in HM manufacturing, today becomes even more strategic and necessary in order to fulfil production needs. In addition, more sustainable production and recycling processes should be pursued, as urged by measures of various governments to tackle climate change.

A variety of tungsten carbide recycling technologies have been developed over the last century for different WC-Co-based scraps. These secondary sources are typically represented by HM soft and hard scraps (Figure 12): respectively by-products and residues of the manufacturing process with a not defined shape, and end-of-life tools and production rejects. Among recycling processes, chemical recycling is the one able to treat all kinds of HM scraps with the highest versatility in terms of both quantity and quality of obtained recovered products. As shown in Figure 8, it involves a deep transformation of scrap materials through combined thermal and chemical treatments, resulting in intermediate products that are processed to extract pure metals. Common chemical processes often require highly reactive alkaline treatments and convert tungsten into high-purity ammonium paratungstate (APT) or Na_2WO_4.[7]. These processes are similar to those used for treating tungsten concentrates and can be integrated into plants originally designed for raw material conversion, obtaining tungsten and tungsten carbide (WC) powders with properties comparable to those derived from concentrates.

An alternative selective treatment, acid leaching, can be applied to both WC-based scraps and oxidized materials. Acid leaching of WC-based scraps in inorganic acid solutions selectively dissolves binder metals, leaving the WC phase intact for reuse. For oxidized materials, the process dissolves $CoWO_4$ in strong acids while leaving WO_3 mostly undissolved. This method targets recycling fractions for the same industrial applications as the original scraps.

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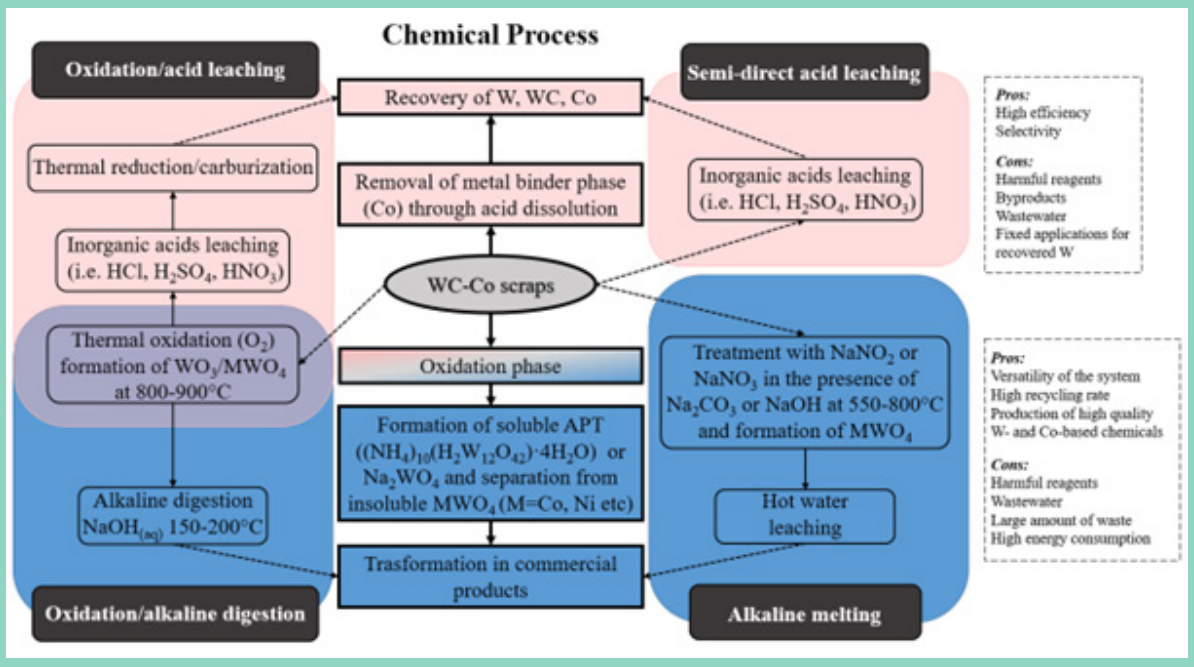


Figure 13 : Scheme (central column) and examples (lateral columns) of hardmetals chemical recycling processes under acid (above top part in pink) and alkaline (bottom part in blue) conditions. Sourced by ref. [7].

The use of bio-based organic acids in hydrometallurgical processes is gaining attention as a safer, renewable, and cheap alternative to strong inorganic acids for selectively leaching binders from WC-based scraps (Figure 14). Unlike cobalt, tungsten carbide (WC) is largely unreactive to weak non-oxidizing acids, and tungsten's redox and coordination chemistry are poorer than cobalt's. This makes selective cobalt leaching feasible with the right complexing and oxidizing agents. Additionally, due to their complexing abilities in deprotonated forms, organic acids are a promising alternative to strong inorganic bases for leaching metals from WO_3-based materials. [7], [8]

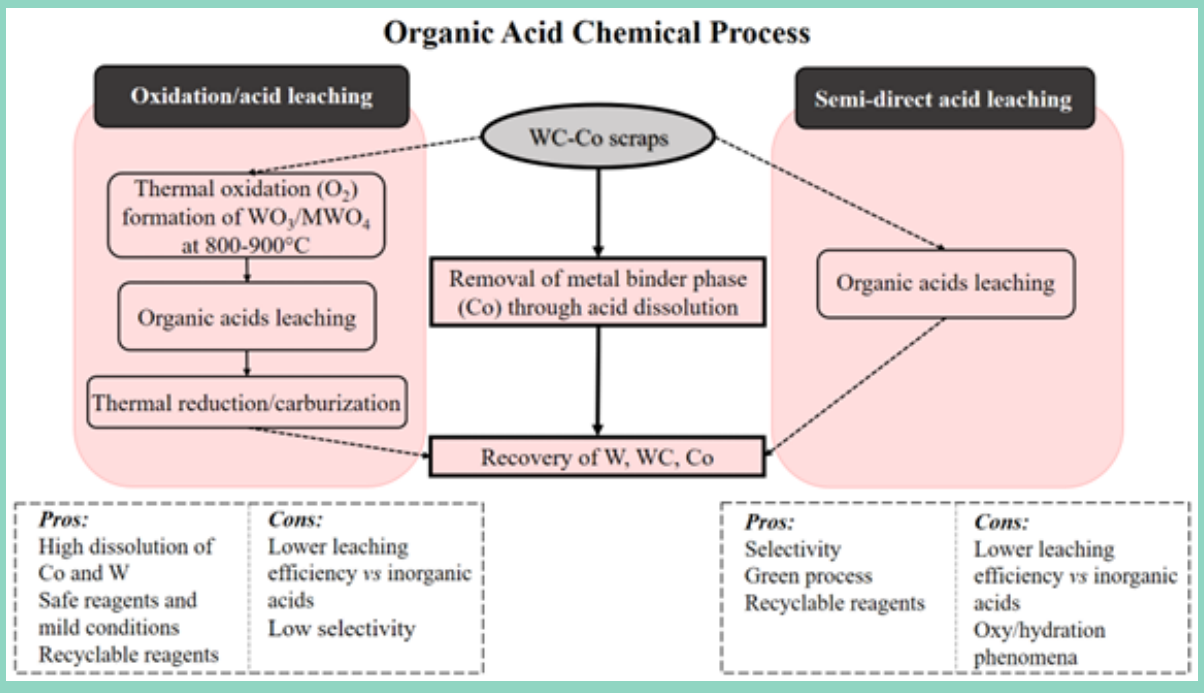


Figure 14 : Scheme (central column) and examples (lateral columns) of HM organic acid chemical recycling processes. Sourced by ref. [3].

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In this framework, the multidisciplinary Chemistry & Environmental Engineering group of the University of Cagliari (C&EEG-UNICA, Italy), able to combine expertise for chemical to bio-technological processes for organic and inorganic waste valorization, is addressing its efforts to recover critical raw materials from HM scraps by-deriving valued organic acids from agro-industrial residues, in order to promote "zero waste" and low environmental impact circular economy models.

CONTRIBUTION OF C&EEG-UNICA IN THE RESQTOOL'S FRAMEWORK

Under a long-lasting cooperation with F.I.L.M.S. SpA, C&EEG-UNICA is applying a new patented process for the production of a powerful metal leaching mixture based on organic acids, to Co and W recovery from a variety of W-based HM waste materials.[9], [10] This mixture is the result of a low cost and controlled process of dark fermentation of dairy waste, preventing wastewater production by cheese farms and using low CO_2-footprint and safe chemicals for metal leaching and recovery. The combination of the bio-based chemical leaching provided by C&EEG-UNICA and the thermal Oxidation/Reduction/Carburization performed by F.I.L.M.S. (combined in the Bio-based Chemical Recycling, Bio-CR) demonstrated to achieve a high recovery yield of Co and W contained in hard and soft HM waste in very mild conditions, obtaining high quality recovered products suitable for carrying out a new HM manufacturing cycle. During the RESQTOOL project, this process will be furtherly validated on different scraps and on an increasing scale in order to increase the TRL (Technology Readiness Level) from 5 - Technology validated in relevant environment - to 7 - System prototype demonstration in operational environment.

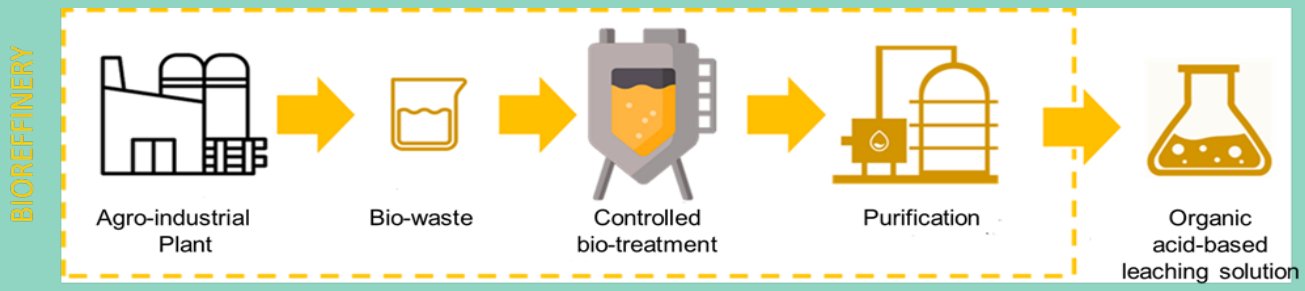


Figure 15 : General scheme of the patented process by UNICA for the leaching mixture production from dairy waste.[8]

RESQTOOL EVENTS

2TH ICSHM IN SRI LANKA

The RESQTOOL project participated in the 12th International Conference on Science of Hard Materials (ICSHM1211), held in Bentote, Sri Lanka, from March 11th to 15th, 2024 [11]. This conference is the latest instalment in a series that began in 1981, following on from earlier Hard Materials Workshops sponsored by the National Science Foundation's Division of Materials Research in the USA. The previous edition was held in Thailand in 2019. The conference provided a valuable platform to present various aspects of the RESQTOOL project. Partner institutions utilized the opportunity to hold productive internal meetings in addition to project presentations.

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Two presentations were delivered at the conference:

Tuesday, March 12, 2024, 9:00 – 9:20 AM, Session 4: Processing and Sustainability: "Valorisation of hardmetal wastes using organic acids in an eco-friendly process" by M. Cera, G.P. De Gaudenzi, S. Tedeschi, A. Muntoni, G. De Gioannis, and A. Serpe (University of Cagliari). This presentation focused on a key RESQTOOL technology for hardmetal recycling: the utilization of organic acids for extracting different constituent materials.

Friday, March 15, 2024, 11:30 – 11:40 AM, Session 13: The future of Hard Materials: "Presentation of the ResQTool project" by J. Pötschke (Fraunhofer IKTS). This brief communication provided an overview of the RESQTOOL project's fundamental approach (Figure 17). A downloadable PDF version of this presentation is available on the RESQTOOL website's "Documents" page.

Both presentations sparked significant interest among the audience. Additionally, project information was disseminated to attendees through a roller banner and leaflets, effectively reaching the international gathering of hard materials experts in Bentote.

On Tuesday 12th March, project members from UNICA, FILMS, IKTS, CEIT, CERATIZIT, SANDVIK and HILTI, and some connected remotely, held project meetings that were related to activities in Project's Work Packages 1 and 3. The conference provided a valuable platform to present various aspects of the RESQTOOL project. Partner institutions utilized the opportunity to hold productive internal meetings in addition to project presentations.



Figure 16 : The banner of the ICSHM12 event.





Figure 17 : The presentation given by J. Pötschke at the ICSHM12 event.

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Metal Show & TIB in Bucharest

The RESQTOOL Project exhibited for the first time in an International Fair at the Metal Show and TIB in Bucharest (Romexpo Pavilion B2), 14th-17th May. At our project booth, our coordinator Kenan Boz (EPMA) met all interested visitors and explained all details about our project. The stand was equipped with a roller banner and some posters describing the main features of RESQTOOL, and in addition to that a looping video (that you can watch on our YouTube channel [12]) allowed the passer-byers to get a feeling of the project in a short time.

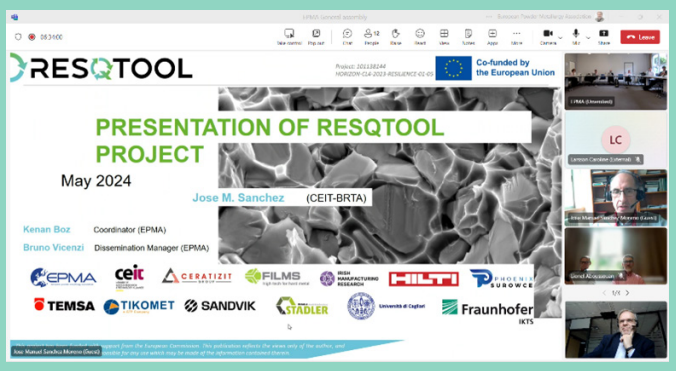


Figure 18 : The RESQTOOL booth at the Metal Show & TIB in Bucharest (Romania).

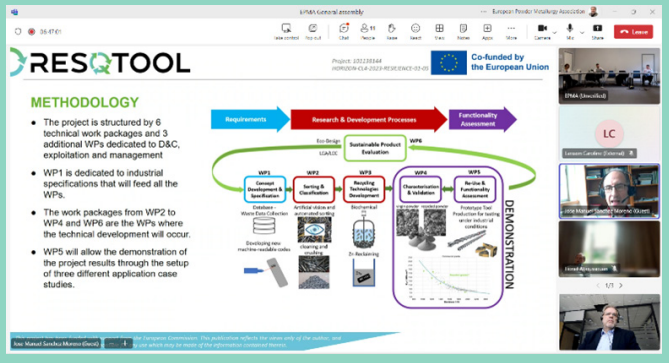
The fair's website describes it as "the largest technical fair in Romania over the past 15 years". Its focus is specifically on the metalworking industry, while also encompassing related fields that utilize industrial technologies and equipment for metal processing. With roughly 200 exhibitors from 20 countries and exceeding 4,300 visitors this year, the fair boasts a significant presence within the Romanian industrial landscape. Did you take part, and did you meet Kenan?

EPMA General Assembly 2024

A presentation on RESQTOOL was delivered remotely by J.M. Sanchez Moreno (CEIT-BRTA) at the EPMA General Assembly 2024, in Brussels (Belgium) and hybrid, on 16th May 2024. In the afternoon, our partner spoke for 20' with the self-explaining title "Presentation of RESQTOOL project" to about 30 EPMA members, both present in the Brussels venue, and connected remotely.







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PowderMet 2024

RESQTOOL flew again outside Europe, namely to the USA, to the PowderMet2024, the annual congress of the Metal Powder Industries Federation in Pittsburgh, PA. 16th to 19th June 2024. Johannes Pötschke (Fraunhofer IKTS) presented in the Session "Sustainability II", with the "RESQTOOL HE-Project - Recycling of High-Quality CRM Resources from Machining Tools for Re-use Applications", on Wednesday 19th June.



Figure 20 : Details of J. Pötschke's speech about RESQTOOL at the PowderMet 2024.



The presentation attracted a lot of interest and paves the way to potential collaborations on the other side of the Atlantic Ocean.

Figure 21 : J. Pötschke just before his speech in PowderMet 2024.

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Talk "Progetti europei di ricerca e innovazione"

On 4th July 2024, A. Serpe of UNICA took part in a hybrid event (in Italian) organised by the local newspaper "L'Unione Sarda" and UNICA itself, on the topic "Progetti Europei di Ricerca e Innovazione" (European Research and Innovation Projects). The event was organised by UNICA and L'Unione Sarda to present the European programmes to the general public, specifically Sardinian companies, with a reference to existing R&I projects involving Sardinian units. UNICA, Sardegna Ricerche, and the Regione Sardegna itself presented a selection of projects and experiences. Among them, A. Serpe presented remotely RESQTOOL to the audience, as an appealing and promising example of fruitful collaboration between research institutions and well-established companies, working together to pursue an eco-friendly hardmetals manufacturing circular economy chain!





Figure 23 : A moment of the presentation given by A Serpe of UNICA during the talk organised by the newspaper "L'Unione Sarda" and UNICA on 04/07/2024.



Figure 24 : A moment of the presentation given by A Serpe of UNICA during the talk organised by the newspaper "L'Unione Sarda" and UNICA on 04/07/2024.

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EPMA Summer School 2024

In the framework of the EPMA Summer School 2024 in Alessandria (Italy), 15th to 19th July 2024, RESQTOOL had the chance of presenting its main features to an audience of 63 young trainees from all over Europe, and in a few cases from outside Europe (USA, Canada, India and South Korea).

The EPMA Summer School on Powder Metallurgy is an immersive week where trainees get information on all aspects of the technologies and materials involved, both via direct lectures (Figure 25) from outstanding speakers from Europe's industry and academy, and by lab experiences (Figure 26) organised in the location chosen for the specific edition, that changes every year: this time it was held in the nice city of Alessandria, hosted by the local branch of the Politecnico di Torino and supported by the local Camera di Commercio di Alessandria e Asti. It was the 22nd edition: the first happened back in 1998.

B. Vicenzi (EPMA) mentioned RESQTOOL in the introductory talk of the school on 15th July (Figure 27), and then G.P. De Gaudenzi (FILMS) explained much more during the lecture on Thursday 18th July, 17:30-18:15 (Figure 28) in his presentation titled "The RESQTOOL project".



Figure 25 : The lecture room of the 22nd EPMA Summer School during the introductory speeches.



Figure 26 : The labs of Politecnico di Torino/Alessandria Campus hosted the lab experiences: here, a moment of one of the demonstrations about powder atomisation.



Figure 27 : B Vicenzi addressing the trainees of the 22nd EPMA Summer School on 15/07/2024 with a few words on RESQTOOL.



Figure 28 : G.P. De Gaudenzi addressing the trainees of the 22nd EPMA Summer School on 18/07/2024 with a 45' presentation on RESQTOOL..

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UPCOMING EVENTS

RESQTOOL is also preparing other participations in events in the next months. We hope you will be able to catch up with us there!

Euro PM2024

RESQTOOL is also organising a 3x3 m2 project booth in the EPMA Euro PM2024 Congress & Exhibition, Malmö (Sweden), 29th September to 2nd October 2024. The event is the key Conference and Exhibition for the European powder metallurgy community, with a very strong contribution of hard materials, and in particular hardmetals technical papers and participants.

The RESQTOOL stand will be in a special area dedicated to EU projects, side-to-side with other projects where EPMA is involved,. Look for the stand, and you will have the chance of finding project materials and samples, and possibly discuss with some of us about the details.



Figure 29 : The banner of the Euro PM2024 Congress & Exhibition

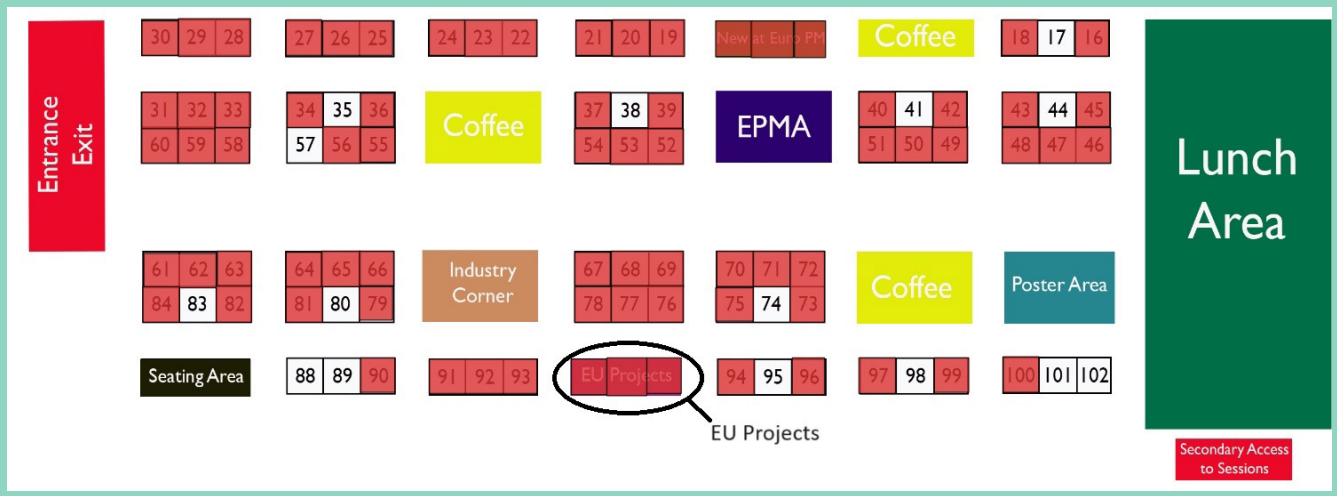


Figure 30 : RESQTOOL will have a booth in the EU Projects area at the Euro PM 2024 Exhibition in Malmö.

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Further events

Later this year; RESQTOOL will continue its communication and dissemination in other events. In particular, these have been listed:

- Hagener Symposium Pulvermetallurgie, Hagen (Germany) 28-29th November 2024

- International Meeting on Circular Metallurgy, Raw Materials, By-products & Recycling, Bergamo (Italy), 28-29th november 2024

- Winterev 2024, London (UK), 10-11th December 2024

In these events, we will have presentations so that you can learn more from our partners if you take part as well.
Keep in touch with our website and social media to know more!

RESQTOOL TEAM TOUR

EPMA (www.epma.com)

The European Powder Metallurgy Association (EPMA) is a non-profit organisation established in 1989 in Brussels, Belgium. It gathers all entities and individuals involved in Powder Metallurgy (PM) processes and technologies, in Europe and even outside Europe. Its scope covers all technologies that are related to the production of metal powders, and their use to produce metal parts, normally via a sintering step. Among these are press & sinter, cold and hot isostatic pressing, metal injection moulding, metal additive manufacturing, FAST sintering processes, and many others.

The mission of EPMA is to promote, support, develop and represent the European PM community, fostering its growth also by connecting industry and R&D.

Members include representatives from the whole supply chain: metal powder producers, producers of feedstocks or powder mixes, metal part manufacturers, postprocessing suppliers, end users, PM equipment and machine producers, service (e.g., testing) providers, consultants, and the European research and innovation community linked to them, from universities or research centres. As of 2024, the members, including companies, universities, research centres and individuals, amount to about 250.

EPMA undertakes constant actions, with the support of its members that are actively collaborating in one of its Sectoral and Working Groups, one of which is expressly dedicated to Hard Materials, the EuroHM group. Among usual activities are:

- The organisation of a yearly European PM Congress & Exhibition (the EuroPM series, see Figure 30) that every 6 years becomes WorldPM (as per agreements with similar PM associations in America and Asia)
- The organisation of some PM technical seminars and workshops every year all around Europe
- The collection of data and statistics about the PM business in Europe and the relevant trends
- The organisation of trainings, like the EPMA Summer School (active since 1998, see Figure 31), the Young Engineers scheme during EuroPMs, and other specific events like workshops and webinars
- The monitoring of the EU regulations impacting on the PM community, like for instance about chemicals (REACh and alike)

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- The participation in EU funded R&D projects, for instance in Horizon Europe (like RESQTOOL) and Erasmus+, to foster innovation in the field of PM

- The coordination of collaborative projects among members (Club Projects) to support and share R&D in Europe

- Various competitions (PM Master's and PhD Thesis Competitions) and Awards (Distinguished Service Award, Fellowship Award, Sustainability Award, PM Components Award) to promote and support the most outstanding efforts in PM workshops and webinars

- The monitoring of the EU regulations impacting on the PM community, like for instance about chemicals (REACh and alike)

In RESQTOOL, EPMA took the role of coordinator, managing the proposal stage, and now managing the execution of the project. In addition to this, and due to its already existing large network of contacts, EPMA has the role of Dissemination and Communication Manager. In this position, EPMA will benefit of its connection to the HM sector via the EuroHM group to channel information to the interested stakeholders, and stimulate cooperation at a wider international level, to facilitate the achievement of the results foreseen by the consortium.





Figure 31 : The EuroPM Congress and Exhibition organised by EPMA yearly gathers about 1000 delegates and visitors from all over the world (and every 6 years becomes officially WorldPM).



Figure 32 : The participants at the 22nd EPMA Summer School held in Alessandria, Italy, in July 2024.



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GET OR KEEP IN TOUCH WITH RESQTOOL

If you read this newsletter and found it interesting, why not enter the RESQTOOL community?

If you have not done it yet, go to our website www.resqtool.com and click "SUBSCRIBE". You will be inserted in our mailing list (you can opt out any time!) and receive info about our activities.

You can also follow us on three social media:

LinkedIn https://www.linkedin.com/company/resqtool-he-project/

X (you know, Twitter): https://x.com/RESQTOOL

YouTube: https://www.youtube.com/channel/UCrONO4fl0r4ZExrOL6FbXLA

All our Open Access documents will be stored on Zenodo. We have a RESQTOOL community there (https://zenodo.org/communities/resqtool), visit it if you prefer downloading or reading there rather than from our website (but the website is cool!).
If you prefer a direct E-Mail, contact our coordinator Kenan Boz, kboz@epma.com

BIBLIOGRAPHY

1 E. Lassner, W.D. Schubert, TUNGSTEN, Properties, Chemistry, Technology of the Element, Alloys, and Chemical Compounds, Kluwer Academic/Plenum Publishers, New York, 1999. ISBN 0-306-45053-4.

2 B.F. Kieffer, E. Lassner, Tungsten Recycling in Today's Environment, BHM (1994) 340–345 (139 Jg., Heft 9).

3 C.M. Weissensteiner, et al., Zinc-Reclaim of Refractory Materials: Mechanisms and Limitations, 19th Plansee Seminar Reutte, RC1/1–1/13, 2017.

4 M. Kurkela, Hardmetal Recycling Developments in Europe with Emphasis on the Zinc-Process, 26th AGM ITIA, Sydney, Australia, 2013.

5 M. A. Moll, 'Tungsten End-Use Analysis 2022/23 First-Use / End-Use of Tungsten', presented at the 36th Annual General Meeting ITIA, Osaka, 2023

6 'Cobalt market report 2022', Cobalt Institute, Guildford (UK), May 2023. [Online]. Available: https://www.cobaltinstitute.org/wp-content/uploads/2023/05/Cobalt-Market-Report-2022_final-1.pdf

7 M. Cera et al., 'Trends and perspectives in the use of organic acids for critical metal recycling from hard-metal scraps', International Journal of Refractory Metals and Hard Materials, vol. 114, p. 106249, Aug. 2023, doi: 10.1016/j.ijrmhm.2023.106249.

8 A. Serpe et al., 'Processo per la produzione di una miscela lisciviante da scarti di prodotti caseari', Italian patent No. 102022000007502, 2022; PCT publication No. WO2023/199263.

9 A. Oumarou Amadou et al., 'A comparison among bio-derived acids as selective eco-friendly leaching agents for cobalt: the case study of hard-metal waste enhancement', Front. Environ. Chem., vol. 4, p. 1216245, Jun. 2023, doi: 10.3389/fenvc.2023.1216245.

10 Oumarou Amadou, A. et al., 'A new facile solvometallurgical leaching method for the selective Co dissolution & recovery from hard metals waste', International Journal of Refractory Metals and Hard Materials, vol. 98, p. 105534, 2021, doi: 10.1016/j.ijrmhm.2021.105534.

11 https://www.icshm12.org/

12 https://www.youtube.com/watch?v=Y1nO5sYiF28

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