

PRESENTATION OF RESQTOOL PROJECT

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SUSTAINABLE HARDMETAL RECYCLING FOR A GREENER FUTURE

- 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 losing the high hardness of carbide components.
- Carbides are usually Tungsten Carbide (WC), Titanium Carbide (TiC) or Tantalum Carbide (TaC). The binder metal used as the matrix is Cobalt (Co), Nickel (Ni) and Iron (Fe)
- Hardmetals today form the backbone of the tool manufacturing industry with diverse applications
- They show a wide range for the combination of high hardness and toughness, making them suitable for many wear applications such as:



Metal Cutting Tools



Mining/Rock Drilling



Wood Cutting Tools



Industrial Wear Parts

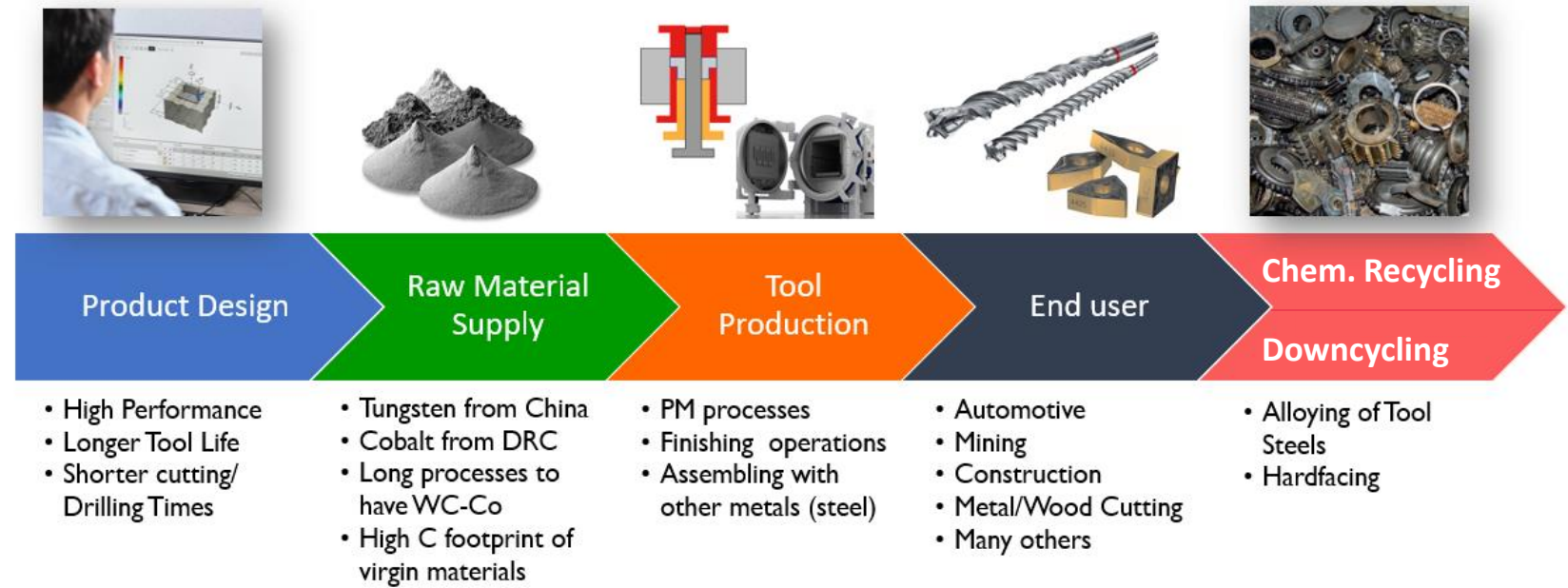


Metal Forming Dies

PROJECT OBJECTIVE

Current State of the Art:

Complete Value Chain of
Hardmetals in EU



Global objective: Offer a sustainable and energy efficient solution for recycling and responsible supply of Critical Raw Materials (Co, W, Ta, Ti, Nb) from EoL products in metal/wood cutting, construction and manufacturing industries by lowering the carbon footprint of Zinc Reclaim process and developing advanced hydro- and solvo-metallurgical chemical recycling based on agro-industrial waste-bioderived chemicals.

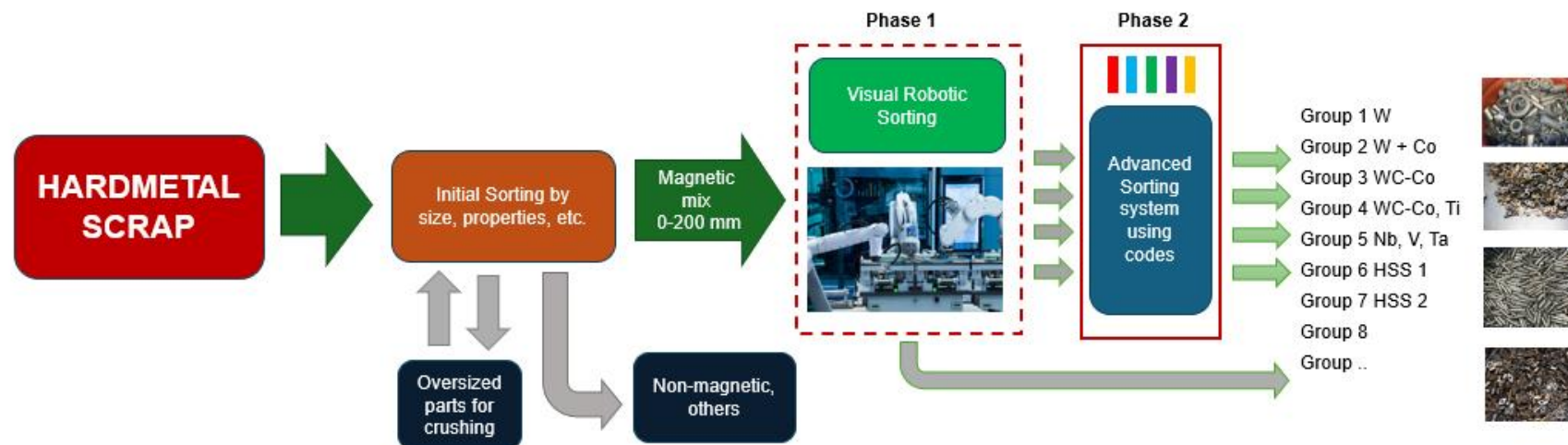
PROJECT OBJECTIVE

RESQTOOL Proposal: Complete Value Chain of Hardmetals in EU after the project is completed



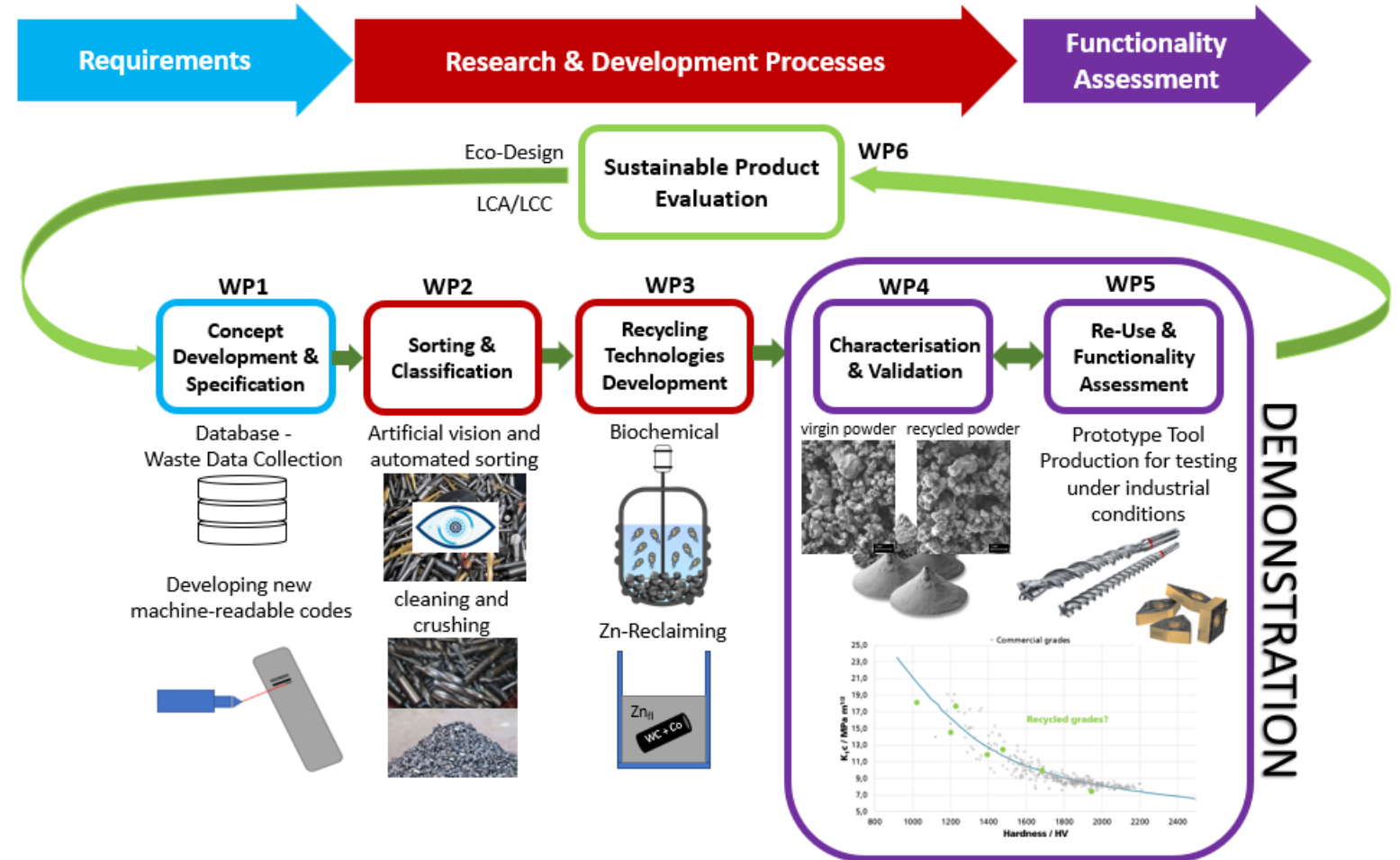
HOW TO?..

- **RESQTOOL** will identify HM scrap sources by their initial Industry uses.
- This will serve for identification of a certain recycling code for each group to be used in determining their recycling scheme.
- 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 etc. important for its segregation and recycling.
- Every group will be forwarded to a certain recycling scheme.



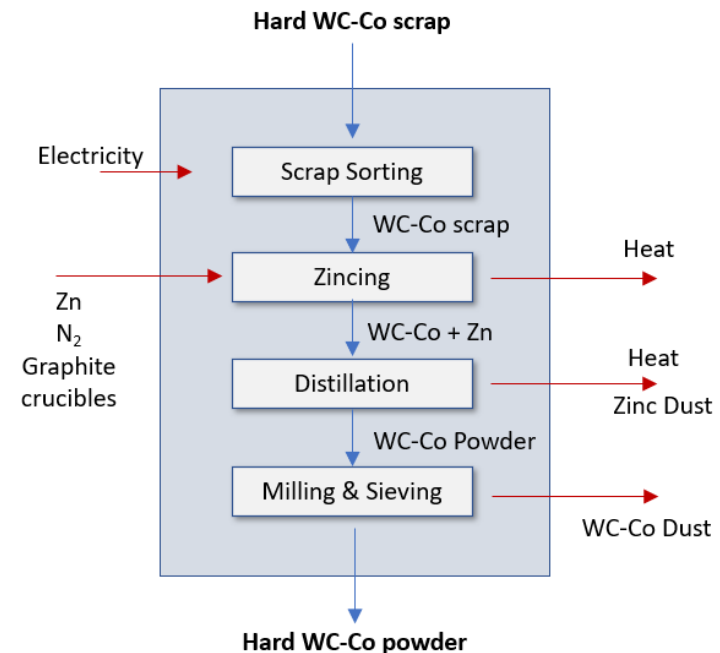
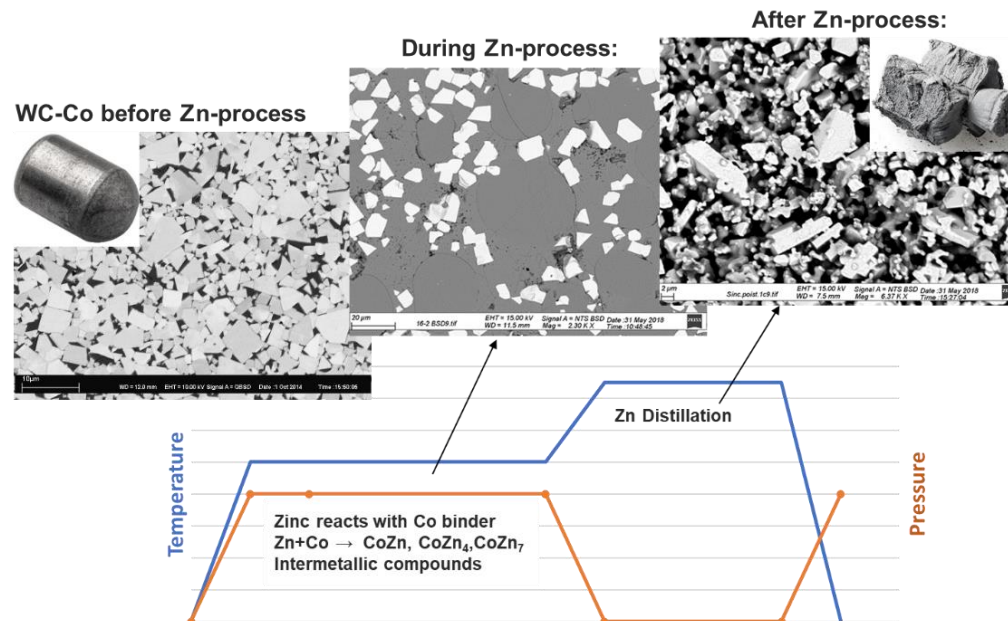
METHODOLOGY

- The project is structured by 6 technical work packages and 3 additional WPs dedicated to D&C, exploitation and management
- WP1 is dedicated to industrial specifications that will feed all the WPs.
- The work packages from WP2 to WP4 and WP6 are the WPs where the technical development will occur.
- WP5 will allow the demonstration of the project results through the setup of three different application case studies.



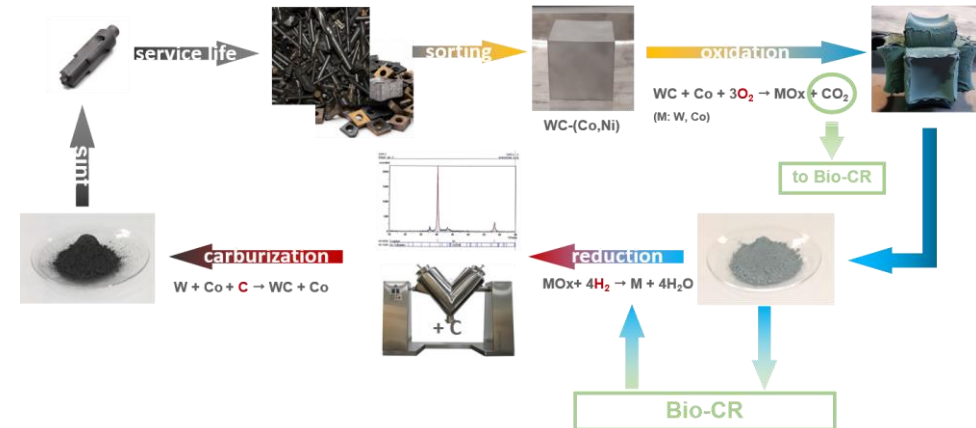
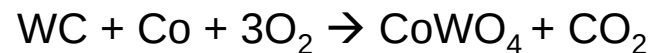
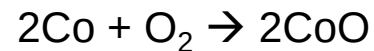
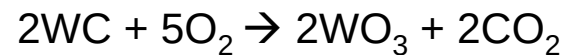
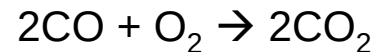
ZINC RECLAIM

- In the current Zinc process, there are 2 compartments in the furnace, one with heating and one with cooling.
- Crucibles that are on the hot zone, contains HM scrap and zinc while the crucibles on the cold zone are empty.
- When crucibles on the hot zone are heated, zinc reacts with the cobalt phase of the HM scrap.
- After the reaction, temperature is increased, and pressure decreased so that the zinc starts to boil and evaporate.
- Zinc vapor is transferred into the crucibles on the cold zone and is condensed and recovered. Recovered zinc is used then in the next batch

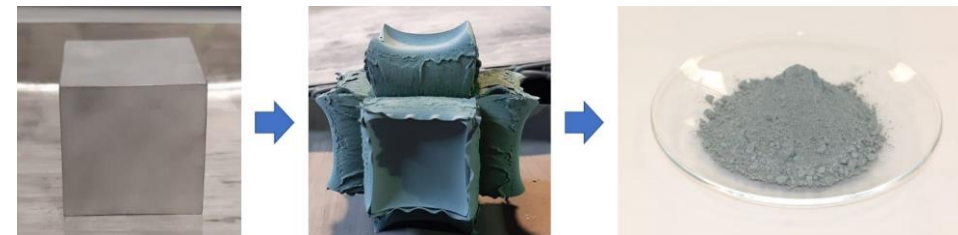
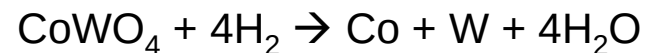
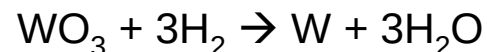


BIO-CHEMICAL RECYCLING

- The oxidation is the first step of the “semi-direct” pyrometallurgical process that comprises also the reduction of oxidized powders and the following carburization of tungsten in the powder mixture.
- Oxidation in air at temperature in the 700 to 900 °C of selected uncoated WC-Co base hard scraps can be described, e.g., by the following reactions:

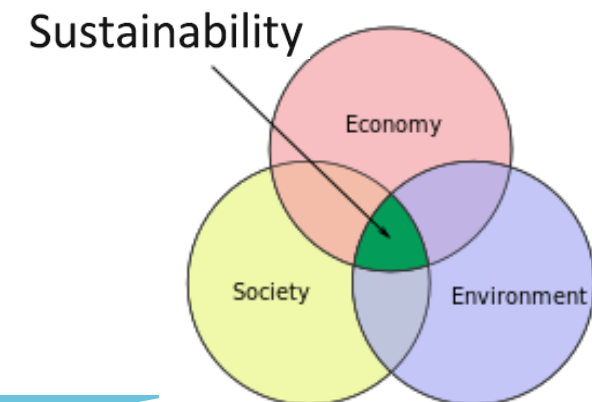


- Due to the Pilling-Bedworth ratios of W and Co, hard scrap loses consistency and is easily pulverized. The oxidized powder can be treated in a reducing environment at 800-1000 °C in order to get a mixture of W and Co powders, according to the following reactions:



EXPECTED IMPACTS

- Higher re-use of raw materials and resources with reduced environmental impact and lower costs as demonstrated by Life Cycle Assessment
- Responsible supply of critical raw materials to Europe in line with the EU principles for sustainable raw materials through application of a circular economy
- Contributing to EU climate neutrality objectives by decreasing level of resource and energy consumption leading to a lower CO₂ footprint
- Increase productivity, innovation capacity, resilience, sustainability and global competitiveness of European energy intensive industries
- Determination of requirements for sustainable critical raw materials recovery and processing in Europe in terms of social, environmental and economic performance



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THANK YOU

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