MINERAL BENEFICIATION SOLUTIONS FOR CRMS IN EXTREME CONDITIONS: A SWOT ANALYSIS

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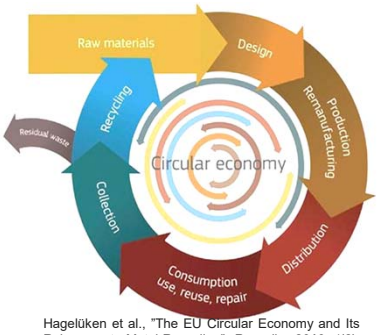
Mineral Processing technologies have found in the last years a promising workfield in the recovery of **secondary raw materials** (**SRM**). This approach, ranging from mineral phases characterization to comminution operations, and then to mineral separation and concentration, has a paralellism with conventional processing routes of **primary raw materials** (**PRM**). The main targets are, at least theoretically, the same: getting highest possible liberation degree with minimum specific energy consumption, and producing concentrates using the best available technologies (BAT) to optimize values recovery and to minimize tailings production. A SWOT analysis is presented as an initial assesment of the situation and as a basis for strategic planning.



Hagelüken et al., "The EU Circular Economy and Its Relevance to Metal Recycling", *Recycling* **2016**, *1*(2), 242-253; https://doi.org/10.3390/recycling1020242

STRENGTHS

- Existence of strong research infrastructures within the EU that can cope with this challenge
- The SRM processing can take advantage of the sound experience gained in PRM processing, specially in the case of fines processing
- In the particular case of secondary mining:
  - The re-processing of tailings deposits can be at the same time an environmental and economical action
  - Production sources and deposits can be easily located
- Easy access to R&D information sources around the world

WEAKNESSES

- Mineral characterization of SRM can be more difficult and processing must be more focused on fines and slimes
- Some properties of the SRM, specially in the case of RM under extreme conditions, can be modified during its performance → a secondary use different to the primary one must be found
- SRM properties can vary in space and time, needing a more complex processing with tighter control
- SRM production level is difficult to predict, both in terms of mass flow and quality

OPPORTUNITIES

- Growing interest in eco-design of products, considering from the very beginning the possibility of recovery of SRM
- EU policies within a circular economy context and incentives to local production can be developed to promote productive activities of SRM and PRM
- The production using BAT and innovative technologies is an opportunity for positioning EU at the highest standards in Mining & Mineral technologies
- Industry 4.0 developments have started to reach the raw materials sector, setting the basis of an evolution towards Smart Mining and Smart Processing

THREATS

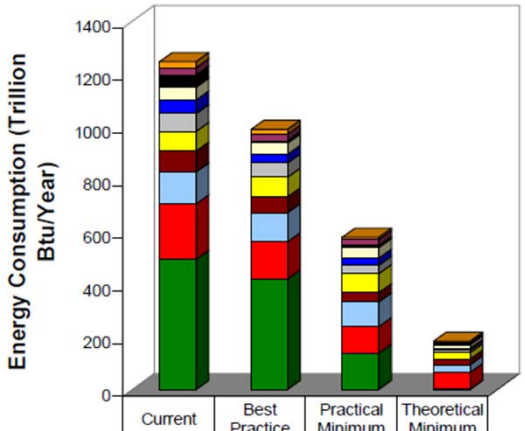
- The difficulty in the production forecast of SRM can reduce the potential interest investment and also the potential scaling-up of the plant.
- Focusing raw materials policies only in SRM can go in detriment of PRM production opportunities
- In general terms, mining in the EU (both primary and secondary) has a low level of social acceptance
- In general terms, SRM cannot always compete in the market with PRM under equal conditions (specially in terms of price and quality.)

MAIN CHALLENGES IN THE BENEFICIATION OF PRM AND SRM

- Higher energy efficiency in comminution:
  - Grindability studies: from crushing to grinding
  - Microwave / ultrasound treatments, grinding aids, electro-fragmentation
  - Efficiency in classification operations: Hydrocyclones
- Greener Processing: gravity concentration, froth flotation
- Higher recovery from primary sources: Fines processing (tailings)
- Higher recovery from secondary sources: recycling of C&DW's, slags, electronic scrap, industrial sludges and other secondary raw materials (refractory concretes)
- Greening The End: zero tailings, soil remediation

WHO & WERE

Mineral Raw Materials Processing Lab facilities and equipment at the Polytechnic School of Mieres (University of Oviedo, Spain)



	Current	Best Practice	Practical Minimum	Theoretical Minimum
Blasting	24	18	10	5
Dewatering	28	25	23	7
Separations	46	8	7	2
Electric Equipment	48	43	40	13
Crushing	52	32	27	8
Drilling	67	54	32	9
Ancillary Operations	75	75	72	24
Digging	79	60	35	22
Ventilation	122	111	94	29
Materials Handling-Diesel	211	141	101	63
Grinding	494	420	138	2

Mining Industry Energy Bandwith Study, Department of Energy, USA (2007). Available at: https://www.energy.gov/sites/prod/files/2013/11/f4/mining_bandwidth.pdf

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