

# DEMONSTRATIVE PILOT PLANT FOR THE VALORISATION OF NON-FERROUS METAL.

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## INTRODUCTION

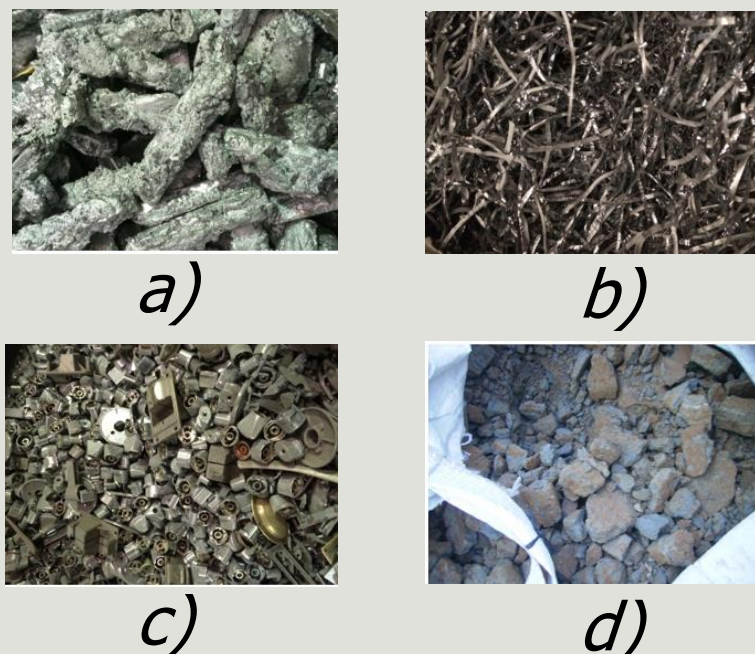
Nowadays, most of the resources contained in wastes are being spoilt by depositing them in controlled landfills.

The following work, developed within the European project LIFE+GREENZO, aims to obtain a new source supply of zinc oxide (ZnO) from industrial waste. A pre-industrial pilot plant using plasma technology has been developed to obtain ZnO from non-ferrous metal waste (zamak). The ZnO has to meet all requirements (physical and chemical properties) to ensure its validation in two industrial sectors: the manufacture of rubber and chemical catalysts.

## PREPARATORY ACTIONS

TYPE OF WASTES / CHARACTERIZATION (% w/w):

- Single metal composition (zamak foundry slag, metal shavings and defective pieces) : Zn ( $\approx 95\%$ ), Al ( $\approx 4\%$ ) and others: Mg, Cu, Fe, Pb, Cd, Sn,... ( $\approx 1\%$ ).
- Mix metal/polymer composition (sludge vibrated): Zn ( $\approx 55\%$ ), Si ( $\approx 9\%$ ), Al ( $\approx 3\%$ ) and others: Cu ( $\approx 0.5\%$ ), Fe ( $\approx 1\%$ ),...

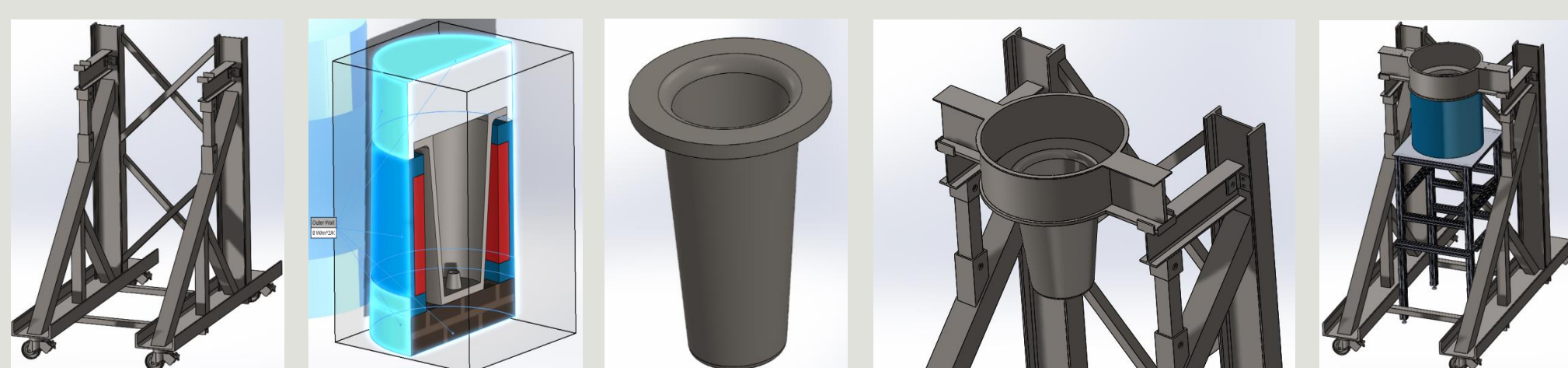


**Figure 1.** Selected wastes: a) zamak foundry slag, b) metal shavings, c) defective pieces and d) sludge vibrated.

ZnO REQUIREMENTS (PHYSICAL AND CHEMICAL SPECIFICATIONS):

- Chemical catalysis: specific surface area ( $2.5-12\text{m}^2/\text{g}$ ), particle size ( $<100\text{nm}$ ), basic or neutral medium, positive presence (Al, Cu, Ni, Fe).
- Rubber/EVA polymer transformation: specific surface area ( $3-7\text{m}^2/\text{g}$ ), particle size ( $<45\mu\text{m}$ ), purity  $>99\%$  (w/w), positive presence (Al, Cu, Ni, Fe).

PILOT PLANT DESIGN (MODULS):



**Figure 2.** Several moduls of pilot plant design.

## RESULTS AND DISCUSSION

PILOT PLANT CONSTRUCTION AND ASSEMBLY:

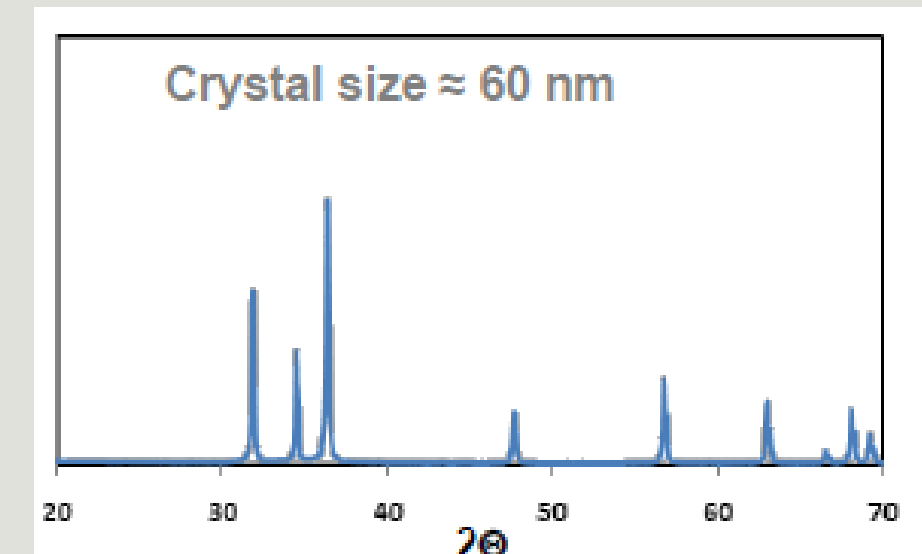


**Figure 3.** Assembled moduls of pilot plant.

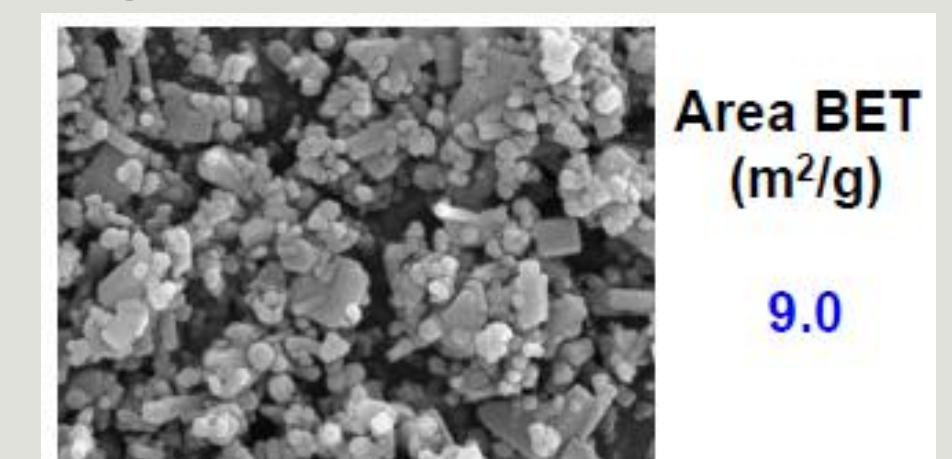
MODULE	DESCRIPTION
1	Foundry system.
2	Continuous extraction of solidified material.
3	Plasma chamber.
4	Filtration system and particle retention (zinc oxide).
5	Storage unit (zinc oxide).

VALORIZED ZINC OXIDE CHARACTERIZATION:

PARAMETER	VALUE (w/w)
ZnO	96.2%
SiO <sub>2</sub>	0.1%
Al <sub>2</sub> O <sub>3</sub>	1.1%
Fe <sub>2</sub> O <sub>3</sub>	0.17%
K <sub>2</sub> O	0.01%
CaO	0.1%
MgO	0.03%
TiO <sub>2</sub>	0.02%
CuO	0.2%

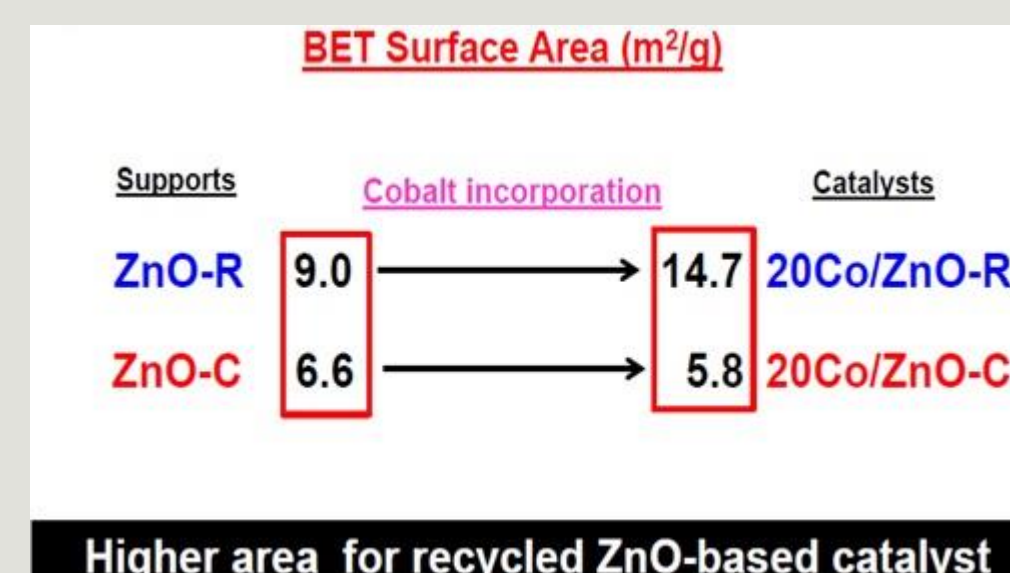


**Figure 4.** Particle size (ZnO).

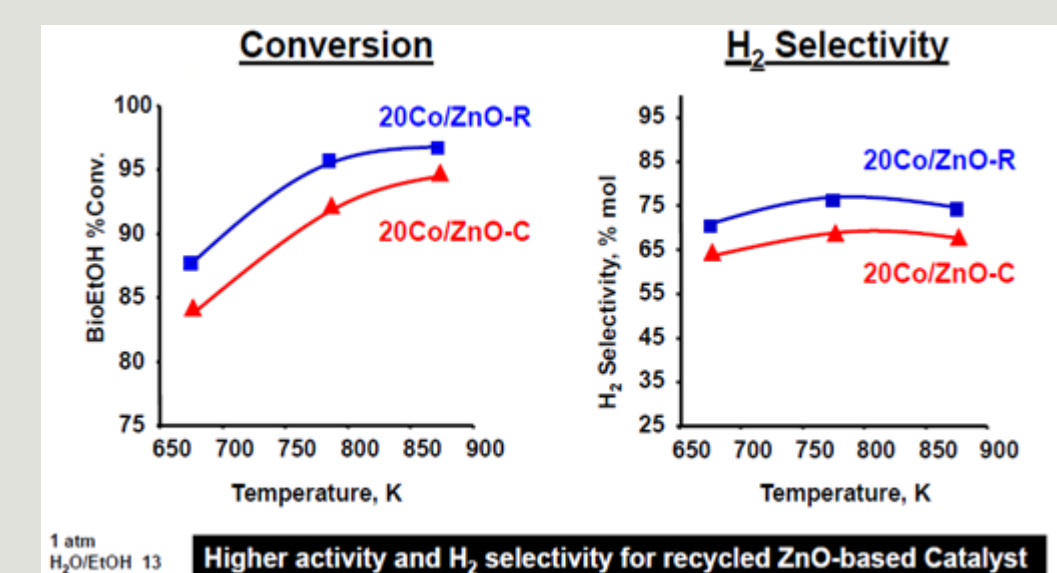


**Figure 5.** Surface area (ZnO).

DEMONSTRATOR 1. CATALYST IN THE REFORMING OF BIO-ETHANOL:



Higher area for recycled ZnO-based catalyst



Higher activity and H<sub>2</sub> selectivity for recycled ZnO-based Catalyst

**Figure 6.** Surface area catalysts. **Figure 7.** Conversion/H<sub>2</sub> selectivity.

DEMONSTRATOR 2. CATALYST IN THE VULCANIZING OF RUBBER/EVA:

- Currently under development.

## CONCLUSIONS

- This is a viable technology to valorize this kind of industrial waste and to obtain a new source supply of zinc oxide.
- This is the first time a steam reforming process is described, in which the raw material (bioethanol) and the catalyst support (ZnO) have renewable nature.
- ZnO valorized has a lot of possibilities to be used in other industrial applications.



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