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A BRIEF REVIEW ON RECOVERY OF CERIUM FROM GLASS POLISHING WASTE

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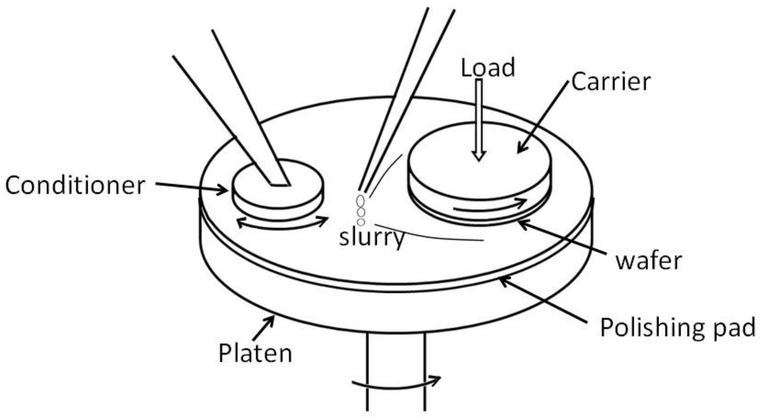
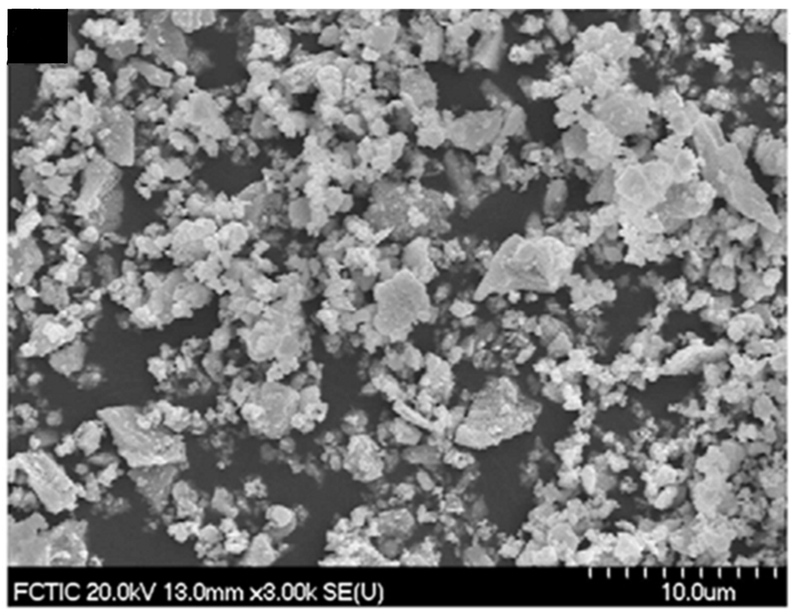
Introduction



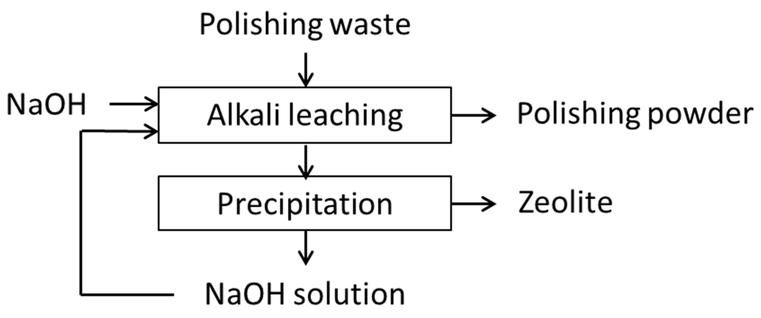
- Cerium dioxide is the main component (40 – 99 %) in glass polishing powder.
- Current consumption of rare earth (RE) oxides in glass polishing is 16,000 t.
- Polishing waste contains rare earths, silicon, iron, aluminium etc.
- Polishing waste (CeO_2: 8-80 %) ends up in landfills.
- Recycling contributes to the proper utilization of natural resources.
- The recovered cerium can be used in high value aluminium and magnesium alloys and steels. It generates highly added value from waste and closes metal loops.

Physical separation

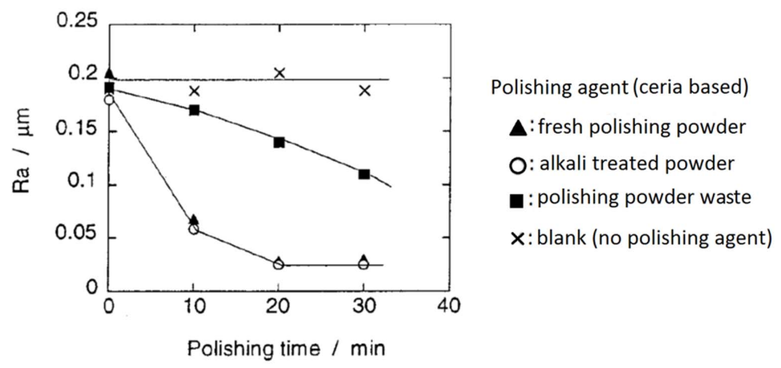
- Silica is a major impurity in polishing waste.
- Flotation can partially remove the silica.
- Difficult to remove all the silica particles as the particle size is very small (< 5 µm).



Alkali Leaching

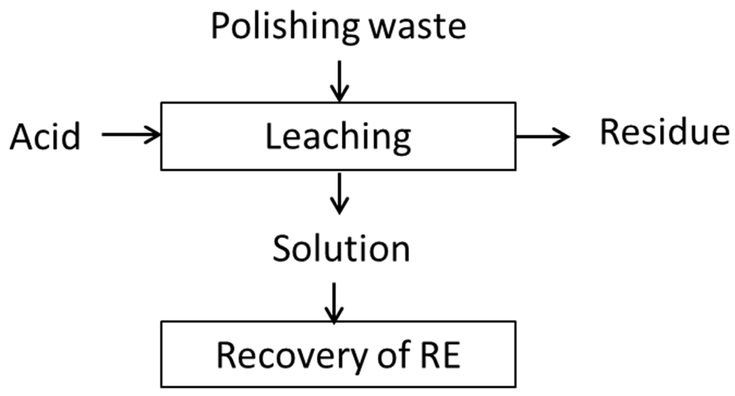


- Removal of glass particles can increase the lifespan of polishing powder up to some extent.
- Removal of silica and/or alumina alone is insufficient after several cycles of reuse.



Direct Acid Leaching

- Cerium dioxide is sparingly soluble in dilute acid solutions at ambient conditions.
- Leaching can be one or two stages depending on the selectivity.
- The recovery of cerium or lanthanum mainly depends on the nature of different compounds in the polishing powder (mineralogy).



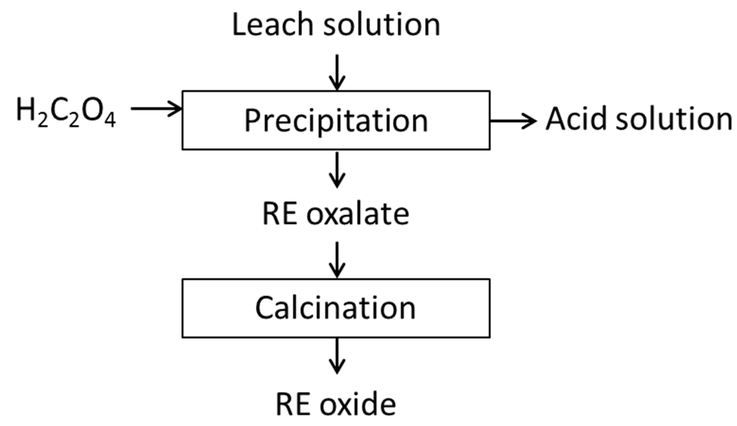
Reductive Acid Leaching

- The use of a reductant can help in decreasing the required acid concentration and leaching temperature.
- H_2O_2 and potassium iodide were used as reductants.

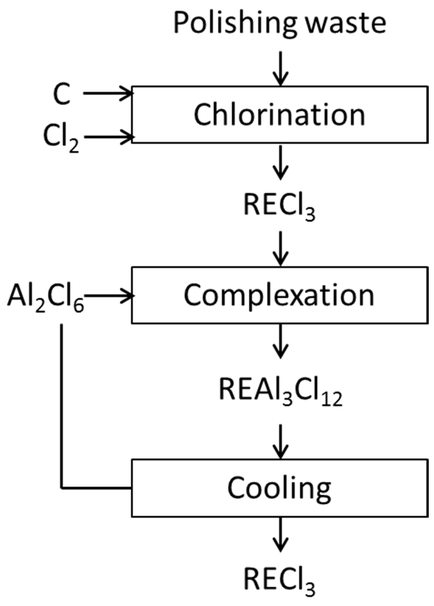
Cerium Extraction

- Different methods: double salt precipitation, oxalate precipitation, carbonate precipitation, hydroxide precipitation and solvent extraction.
- Cerium and lanthanum can be precipitated with oxalic acid followed by calcination.
- Cerium can be selectively precipitated with an oxidising treatment and pH adjustment. Oxidising agents include H_2O_2, potassium permanganate etc.

- After cerium removal by oxidation, lanthanum can be removed by oxalic acid treatment.
- Cerium can be extracted selectively from lanthanum by using D2EHPA and PC-88A reagents through solvent extraction.



Other process



Applications

- The recovered cerium can be used in glass polishing or other applications like redox flow batteries, as a catalyser and as an alloying element.

Conclusion

- Large quantities of polishing waste is being lost in landfills.
- The life of glass polishing powder can be extended by physical beneficiation and/or alkali leaching.
- RE can be recovered from glass polishing waste by acid leaching followed by extraction from leach solutions.
- High acid concentration and/or temperatures or costly reagents (reductants) are required during leaching.
- The extracted cerium can be reused in glass polishing or other high value-added applications.