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Prospective recovery of rare earth elements from waste

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Problem statement

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- The main aim: to determine physical and chemical laws of dissolution of REE precipitates by carbonization;
- Comparison of the behavior of various REE under identical conditions;
- Research an effect of various conditions on leaching;
- Establish the function $\alpha = f(C)$, α – degree of extraction; C – molar concentration of a carbonizing agent

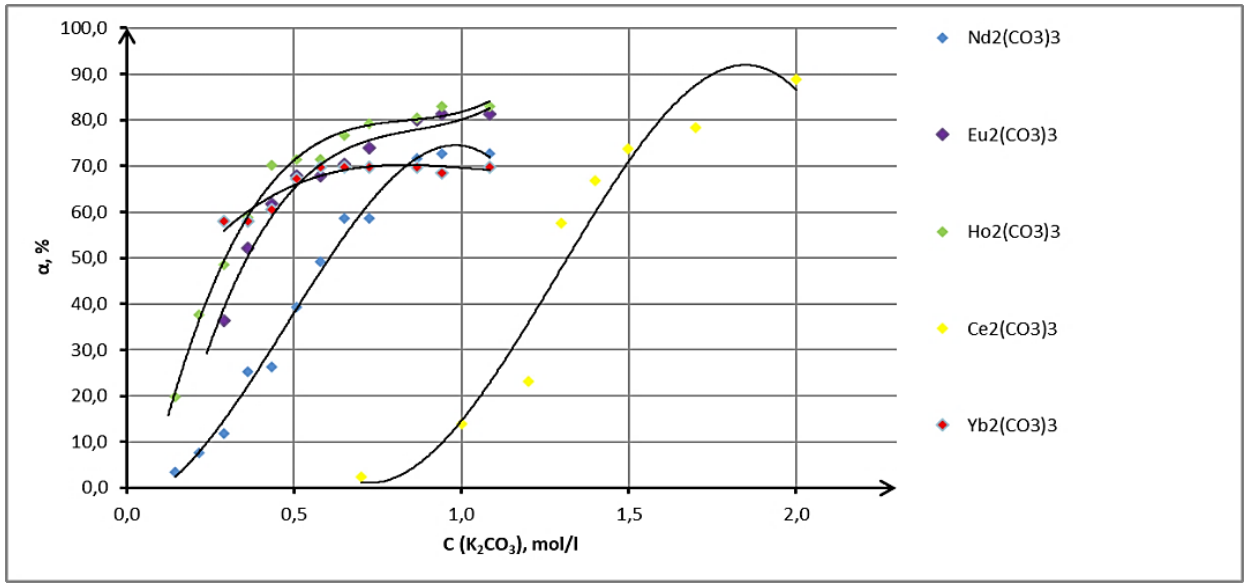
Solution methods

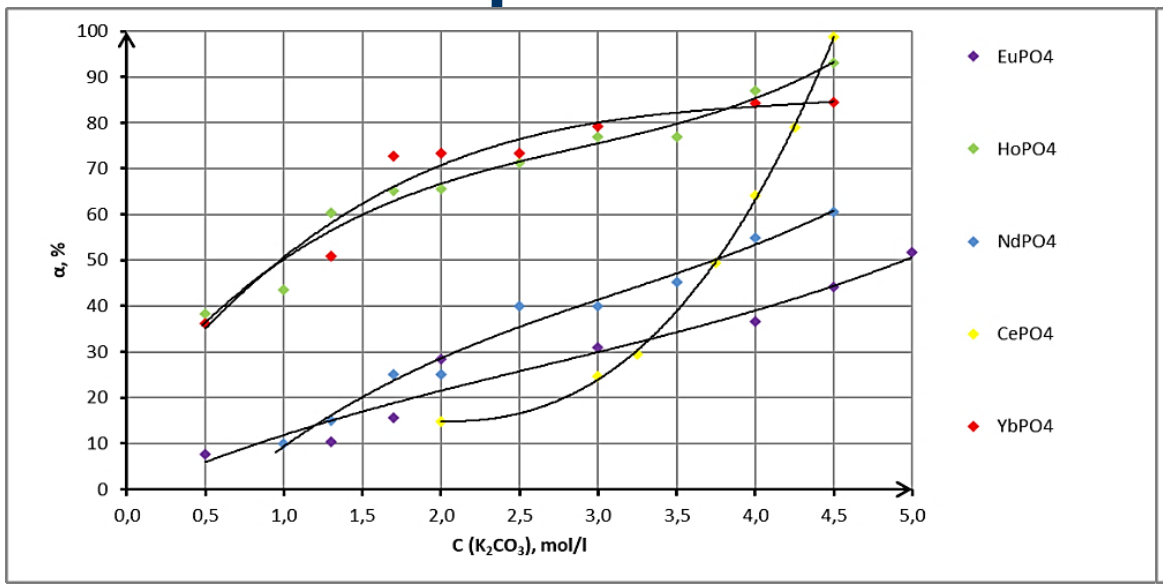
Methods, algorithms, calculations

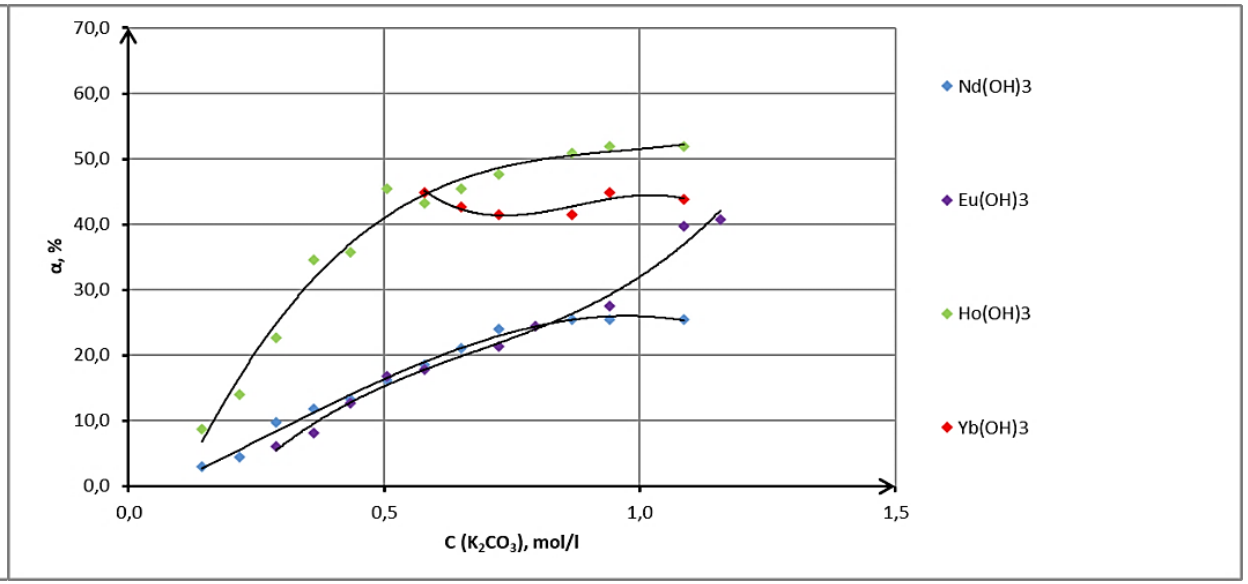
- The research scheme consisted of the following main stages and methods:
- Preparation of model sediments ($REEPO_4$, $REE_2(CO_3)_3$, $REE(OH)_3$); subsequent separation of sediments under vacuum and drying under standard conditions;
- Preparation of model carbonate solutions with a concentration of 0.15 - 5 mol / l;
- Carbonate leaching of REE by using HEL Auto-MATE Reactor System (for thermostatic mixing). Phosphate carbonization was carried out at a temperature of 90 °C, stirring intensity 650 rpm, for 2 - 7 hours, with the initial liquid to solid ratio 2000. Carbonization of carbonates and hydroxides was carried out at a temperature of 20 °C;
- Analysis of REE^{3+} ions extracted into solution by photometric or titrimetric method (Arsenazo III), solid phase research by using X-ray phase analysis;

Solution methods

- Figures







Conclusions

Results, implementation

- A similar solubility of REE carbonates and hydroxides in a carbonate medium is observed in the range of potassium carbonate concentrations 0.15-1.2 mol / l, followed by reaching the maximum degree of extraction into the solution;
- heavy Rare Earth Metals dissolve better than the others;
- REE phosphates dissolve at higher concentrations of the carbonate ion and only at elevated temperatures, with prolonged stirring;
- it has been experimentally established that cerium phosphate and carbonate have the best solubility, but due to the fact that these compounds are exceptions to the rules, their solubility values are not taken into account when deriving solubility patterns;
- Light and heavy metals were taken for experiments; therefore, we can assume a similar behavior of other REE carbonates, phosphates and hydroxides.

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