

Ash-Slag Wastes: the Problem of Recycling

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Technogenic materials form separate and the global problem of modern society. They are a special type of raw material from the one hand and an environmental problem from the another. Most urgent part is the recycling of ash and slag.

Coal of Pechora coal-basin (Russia) is characterised with a relatively high ash content. Pechora coal-basin is represented by almost all types of coal, including coke and anthracite at initial stage. Coals are widely used as a fuel, particularly within the boundaries of the coal-basin (Vorkuta, Inta, etc.). Recycling of solid waste from the combustion of fuel is limited to use as a fertilizer rich in trace elements, as well as export them to the so-called ash field, where the above-mentioned products of combustion are stored for later use.

Ash and slag wastes from thermal power plant (Vorkuta coal deposit) were studied.

The composition of the waste was studied and granular iron ore phase was separated. A hierarchy of its globular structure was made. Iron ore pellets are considered as storage of metals. They can be used after the development of appropriate technologies of extraction and enrichment of [1].

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[1] Scientific basis of mineral and new materials synthesis, development of new geotechnologies, geomaterials, new analytical methods, geoinformation systems, nanotechnological research / Ed. A.M. Askhabov. Syktyvkar: IG Komi SC UB RAS, 2012. 220 p.

Ce-Monazite and Y-xenotime solubilities in H₂O-NaF at 800°C, 1 GPa: implications for REE transport

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Monazite and xenotime host significant rare earth elements (REE) and are useful for geochronology and geothermometry. Their distribution may be impacted by F-bearing fluids, which enhance solubilities of REE and Y in high-grade metamorphism [1]. To assess this we determined the solubility of synthetic CePO₄ and YPO₄ in H₂O-NaF fluids at 800°C and 1 GPa. We used hydrothermal piston-cylinder and weight-loss methods. Compared to the low solubilities of CePO₄ and YPO₄ in pure H₂O (0.04±0.04 and 0.25±0.04 millimolal, respectively [2]), our results indicate an enormous increase in the solubility of both phosphates with increasing NaF concentration in H₂O: CePO₄ solubility reaches 0.97 molal in 20 mol.% NaF, and YPO₄ shows an even stronger solubility enhancement to 0.45 molal in only 10 mol.% NaF. The greatest relative solubility increases occur at the lowest NaF concentration. The solubilities of CePO₄ and YPO₄ show similar quadratic dependence on NaF, consistent with possible dissolution reactions of: CePO₄ + 2NaF = CeF₂⁺ + Na₂PO₄⁻ and YPO₄ + 2NaF = YF₂⁺ + Na₂PO₄⁻. Solubilities of both REE phosphates are significantly greater in NaF than in NaCl at equivalent salt concentration [2]. A fluid with 10 mol.% NaCl and multiply saturated with fluorite [3], CePO₄, and YPO₄ would contain 1.7 millimolal Ce and 3.3 millimolal Y, values that are respectively 2.1-2.4 times greater than in NaCl-H₂O alone. The results indicate that Y, and by extension heavy rare earth elements (HREE), can be fractionated from LREE in fluorine-bearing saline brines which may accompany granulite-facies metamorphism. The new data support previous indications that REE/Y mobility at these conditions is enhanced by complexing with F in fluids phase associated with metamorphism and subduction [4].

[1] Pan & Fleet (1996) *Contrib. Mineral. Petrol.* **123**, 251-262. [2] Tropper *et al.* (2011) *Chem. Geol.* **282**, 58-66. [3] Tropper & Manning (2007) *Chem. Geol.* **242**, 299-306. [4] Cooper *et al.* (2009) *Geochem. Geophys. Geosys.* **13**, Q03024.