

## Direct Calorimetric Measurements of Surface Energies and Phase Stability of Nanophase Oxides

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High temperature oxide melt solution calorimetry is used to measure the energetics of oxide phases as a function of surface area. The effects of polymorphism, surface area, and hydration must be separated. Crossovers in thermodynamic stability of polymorphs at the nanoscale has been confirmed for alumina (alpha and gamma) and titania (rutile, brookite, and anatase). Oxyhydroxides generally have smaller surface energies than anhydrous oxides; thus fine particle size may increase the P-T stability field of hydrous phases. Systematic trends in surface and transformation energies of oxides of Al, Fe, Ti, Zr, and Si are discussed.

## Rare Earth Elements and Neodymium Isotopic Systematic in the groundwaters of French Guiana

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The current use by the population of French Guiana of untreated river water for drinking purposes has important impacts on public health. Consequently, groundwater is of major importance as a possible alternative drinking-water supply to reduce these impacts. The present study is part of a program dedicated to the knowledge of French Guiana aquifers: hard rock fractured and littoral deposits, in order to improve both their prospecting and management. French Guiana covers 10% of the Guyana Shield, which forms the northern extension of the Amazonian Platform. The Guyana Shield mainly comprises granite-gneiss and volcano-sedimentary rocks of Archean to Middle Proterozoic age. An extensive Holocene sandy-argillaceous terrane, borders the Atlantic Ocean.

We report Rare Earth elements (REE) contents as well as the isotopic composition of Nd in groundwaters and surface waters. Groundwater samples were collected from (i) shallow drill holes in this coastal area, which is the only densely populated area in French Guiana, and (ii) deeper wells in the basement around Cayenne and along the Maroni River from which groundwater is pumped from bedrock fractures. Surface water samples were collected from two coastal streams (Yiyi and Kourou) and from one small inland river (Eau Claire).

The determination of REE contents by inductively coupled plasma mass spectrometry and of Nd isotopic ratios by multiple collector mass spectrometer was described in Négrel et al. (2000). The Nd isotope ratios are used to complement the degree of water-rock interaction and clarify mixing processes within the groundwaters.

The contents of individual dissolved REEs and total dissolved REEs in the investigated waters, vary over several order of magnitude and fall within the range observed by several authors either in surface or groundwaters. The values appear broadly independent of other parameters such as total dissolved solids and pH but organic matter seems play a significant role in controlling the dissolved REE contents in waters. REE crustal normalised patterns exhibited relatively uniform patterns with enrichment in heavy REEs.

The isotopic composition of Nd in the waters from French Guiana ranges from  $^{143}\text{Nd}/^{144}\text{Nd} = 0.511377 \pm 9$  to  $0.512162 \pm 8$  associated with a  $^{147}\text{Sm}/^{144}\text{Nd}$  in the range 0.085-0.150, clearly intermediate between that of the parent rocks and that of suspended matter from the Amazon Basin.

### References

Négrel, Ph., Guerrot, C., Cocherie, A., Azaroual, M., Brach, M., Fouillac, C. (2000). *App. Geochem.* **15**: 1345-1367.