A combined AFM and FTIR study of EPS-coated goethite

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Goethite is an important geosorbent in soils and aquifers of temperate climate. Adsorption of extracellular polymeric substances (EPS) to minerals is of environmental concern as the coverage of mineral surfaces by EPS will change interface properties and reactivity. EPS were extracted from *Bacillus subtilis* and *Pseudomonas fluorescens* separately and used for adsorption to goethite. Fourier transform infrared spectroscopy showed structural differences between cell-bound and free EPS. Atomic force microscopy was used to study the interaction between EPS and goethite. Employing phase-shift-imaging we found that up to 60% of the exposed goethite surface was covered by EPS (Fig. 1). Force volume study in air revealed that adhesion changed after EPS adsorption to goethite (Fig. 2). This change of surface property will affect the reactivity and mobility of goethite as a geosorbent.

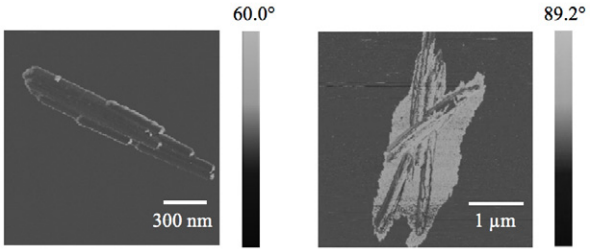

Figure 1: AFM Phase-shift images of pure goethite (left) and of EPS-coated goethite (right).

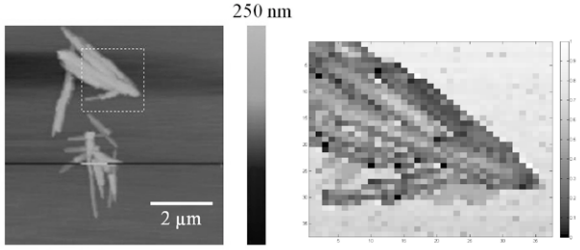

Figure 2: AFM force image (left) and adhesion map of 2×2 µm (right) of EPS-coated goethite. Compared to pure goethite (data not shown), the adhesion force of tip-sample decreased after EPS adsorption to goethite. Further study in liquid is ongoing.

Analysis of microorganisms community composition for column bioleaching test of uranium ores

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Introduction

Acidophilic microorganisms play an important role in both environmental and industrial systems, such as the environmental problems of acid mine drainage (AMD) and bioprocessing termed bioleaching [1]. Most of the microorganisms functioned in bioleaching systems are chemolithotrophic, some of them are heterotrophic and mixtrophic acidophiles. For the composition of microorganisms community in a given bioleaching system has important correlation to the mineral recovery, analysis of the composition give us new insight into the bioleaching processes, as a result to guide the industrial operation.

In this study, both methods were applied to analysis the microorganisms composition.

Results

Two group samples took from the test bioleaching columns of uranium minerals. The first group samples were taken from the stage of uranium concentration in the leachates more than 400mg/l, when the temperature was 25-30°C; the second ones from the latter stage of bioleaching, when the temperature was 35-40°Cand uranium concentration in the leachates less than 20mg/l. Samples were analysed by double layers plates and t-RFLP methods. Results showed the predominant bacteria were *Athidithiobacillus. ferrooxidans* (more than 65%) in the first group samples and *Leptospirillium ferriphilum* (about 50%) and *Athidithiobacillus caldus* (35%) in the second group samples; the minor ones were heterotrophs *Acidiphillum sp.* and *Acidobacterium sp.* in the first group, as well as fungus, *Acidomyces richmondensis*, when the leaching yields were low. The interplay between the microorganisms composition and leaching system indicated that in a given bioleaching system, the microorganisms composition were varied with the temperature and environment of leaching, in the other hand, the varied leaching environment can change the microorganisms composition.

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[1] Schippers, Kock, Schwartz & Böttcher *et al.* (2007) *Journal of Geochemical Exploration* **92**, 151–158.