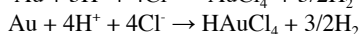
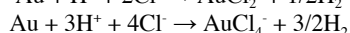
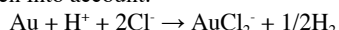


Dissolution of gold in hydrochloric acid

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The purpose of this work is to study hydrochloric acid as an alternative to cyanide for the dissolution of gold in the mining industry. The use of cyanide is controversial due to its toxicity. With hydrochloric acid the process would be safer for the environment and workers. J. D. Clemens showed that hydrogen gas can pass through Teflon at high temperature [1]. When dissolving gold in hydrochloric acid, several reactions should be taken into account:



The removal of H_2 in the system should quicken the process by forcing these reactions to proceed from left to right. Research by Nakata using Teflon vessels showed high gold concentrations compared to previous studies [2]. This is supposed to be due to degassing of H_2 from the system.

A proper combination of parameters will determine if the process is possible and economically viable. By now, it has been found that area of the gold particles, concentration of hydrochloric acid, temperature and time are the most relevant variables. The presence of amorphous phase can determine the speed of dissolution in short time intervals. The manufacturing process, apart from creating amorphous phase as a result of mechanochemical reactions, may inject energy into the surface. If this energy is heterogeneously distributed, activated zones could be preferentially dissolved. Regarding the recycling of gold alloys, composition can be important. The nature of the vessel (Teflon, or other non-permeable) is not important when the experiment is very short (less than ten days).

[1] J. D. Clemens *et al.*, Teflon as a Hydrogen Diffusion Membrane: Applications in Hydrothermal Experiments, *Hydrothermal Experimental Techniques*, 121-140, eds. G.C. Ulmer and H.L. Barnes, John Wiley and Sons, New York. [2] N. Shikazono *et al.*, Dissolution of Gold in Hydrochloric Acid Solution at 150°C, *Hiyoshi Review of Natural Science Keio University* No.11 (1992), 1-4

Colloidal arsenic distribution and speciation in mine soils

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Arsenic associated with colloidal particles is an important vector for As migration in contaminated soils. Using Asymmetric-Flow Field-Flow Fractionation (AsFIFFF) coupled to an inductively coupled plasma-mass spectrometer (ICP-MS), we determined the As distribution as a function of the particle size of the colloidal fraction of soils samples. The samples were collected from stained preferential flow paths and bulk soil samples, impacted by a mine waste. Physical and chemical properties of the colloids were also determined using X-ray-diffraction, SEM and TEM. Arsenic and Fe speciation in the colloidal fraction was characterized using X-ray absorption (XAS) spectroscopy techniques.

Preliminary results indicated that more than 47% of the As mobilized in the preferential flow paths (70.5 mg/L) was associated with the colloidal fraction of the soil. Instead, 5% (2 mg/L) of the mobile As in the bulk samples of the soil was colloidal As. Common to both samples, a similar fractogram (1-1000 nm) was obtained for As, Fe and Al, suggesting an association of As with Fe and/or Al colloidal particles. As XAS analysis of the colloidal fractions (>10 nm) of the soil samples, indicated As adsorption on ferrihydrite as the main As-colloid retention mechanism. The presence of Fe-oxyhydroxides in addition to phyllosilicates was also showed by Fe X-ray absorption analysis. These results show the important role of Fe-oxyhydroxides as nanovectors of colloidal As in preferential flow paths and bulk samples of a contaminated soil.