Investigations on a Membrane Pilot Plant for the In-Situ Treatment of Bioleaching Solutions in a Research Mine

Katja Götze[1], *Roland Haseneder*[1]

[1]*Technische Universität Bergakademie Freiberg, Freiberg/Deutschland*

A testing site for in-situ bioleaching was established in an underground mine to recover indium and germanium from a zinc sulfide ore vein. The downstream processing of the resulting pregnant leaching solution (PLS) is also realized as in-situ application by means of a membrane pilot plant, which was exclusively designed for this special application

The PLS is characterized by high concentrations of the main metal ions zinc, iron and copper. On the contrary indium and germanium are less concentrated by several orders of magnitude. The in-situ bioleaching site has been extensively characterized by geoelectric and seismic measurements to determine the spatial dimension of the ore vein.
The nanofiltration (NF) experiments for the technical design of the membrane pilot plant were performed in cross-flow mode with flat-sheet membrane NF99HF (Alfa Laval) using a synthetic leaching solution (Zn, Fe, Cu, Cd, Pb, In, Ge) to guarantee experimental conditions which are close to the real application.

When performing lab scale NF experiments in continuous cross-flow mode within a pH range between 2 and 8, the separating behaviour of Zn, In and Cu is nearly identical and the retention rate is above 70 %. In contrast, germanium shows a significantly lower retention rate in the pH range under review. The high retention of In, Zn, Cu and Fe indicate a positive membrane charge due to electrostatic repulsion between the positively charged metal cations and the membrane charge.
Based on the experimental investigations of about 4 years, a membrane pilot plant including a microfiltration and NF stage was designed and constructed for the in-situ treatment of the PLS at the first level of the research mine (-147m). Regarding the extreme environmental conditions in terms of high humidity, the design and choice of construction material was of special concern. Furthermore, due to the compact

design of the membrane pilot plant there is only little space required, which is especially suitable for underground mines.

By using membrane technology in the underground mine PLS is efficiently treated regarding pre-concentration of the valuable metal ions as well as reducing the total amount of process water.

Within the talk, first results of the in-situ investigations regarding the process control system and the performance characteristic testing will be presented and discussed.