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MINERAL DRESSING

Occurrence and Mobility of Gold in Old Milltailings

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Abstract—The particle size distribution and the material constitution of samples taken from old milltailings of sulfide and oxidized ore are studied. It is shown that more than 50% of gold occurs in fine size grade of – 0.044 mm. The method of gas adsorption reveals large specific area in the samples, which is important for re-entrainment and migration of gold and associate components. It is found that gold correlates with iron-bearing species, which is useful for the magnetic separation of gold. The differential scanning calorimetry shows that the samples of the milltailings lack significant quantity of carbon black capable to adsorb gold. It is found that it is possible to generate insoluble residuum of iron cyanoferrates in the tailings, and microne size particles of mobile gold will self-settle on them.

Keywords: Gold-bearing milltailings, material constitution, mobile gold, geochemical analysis, magnetic separation.

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INTRODUCTION

The intensive development of gold mining industry in previous decades has resulted in the accumulation of large volumes of man-made ponds containing a significant amount of valuable components. As the gold content in the run-of-mine ores decreases and due to the high environmental load exerted by these dumps, there is a growing demand for effective and economically feasible technologies to recover valuable components from secondary raw materials [1, 2].

The technology for recovering gold from accumulated man-made mineral formations (dumps, tailings and water from gold mills) is quite important for many gold mining enterprises. Since milltailings are characterized by a low gold content and are difficult to process due to oxidation, leaching and re-entrainment, it is necessary to involve both the existing processing methods and new original approaches [3−9]. In recent years, ultrasound and magnetic-pulse methods have been developed for processing milltailings [4], agglomerative flocculation with subsequent flotation [5], new collectors and modifiers in flotation of mining and processing waste materials [6–8], biohydrometallurgical technologies [9], etc.

Despite the problem relevance, there is little work on studying the speciation and migration of elements in tailing ponds of gold mills [10−13]. It is determined that gold is not evenly distributed over the whole tailing pond, but concentrated on locally enriched areas adjacent to the places of pulp discharge [10]. When studying the material constitution of tailing ponds, it should be considered that free gold is usually coated with films of iron hydroxides. The mechanisms of