



ELEMENTAL SULFUR PRODUCTION IN HYDROMETALLURGY

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Keywords: Sodium sulfide; Oxidative leaching; Sulfide ores; Surface active agents; Gold; Mercury.

Elemental sulfur obtained during oxidative leaching of sulfides at low temperature will contain mercury and gold and both can be effectively recovered using sodium sulfide. Other metals go into solution.

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INTRODUCTION

When sulfide minerals are treated in acid medium and in oxidizing atmosphere elemental sulfur forms while the metals go into solution (Figure 1).¹ There is a narrow region where elemental sulfur can form (Figure 2).

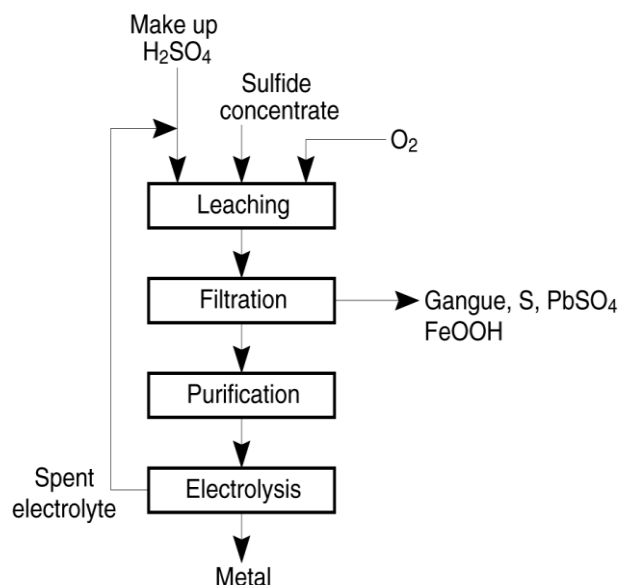


Figure 1. Recovery of metals in sulfide ores below the melting point of sulfur

This region disappears above 150 °C. Sulfur melts at 119.5 °C and polymerizes at 160 °C. If the treatment is conducted below 150 °C a surface active agent must be present to prevent the molten sulfur from impeding the reaction by forming a protective layer on the sulfide particle (Figure 3).²

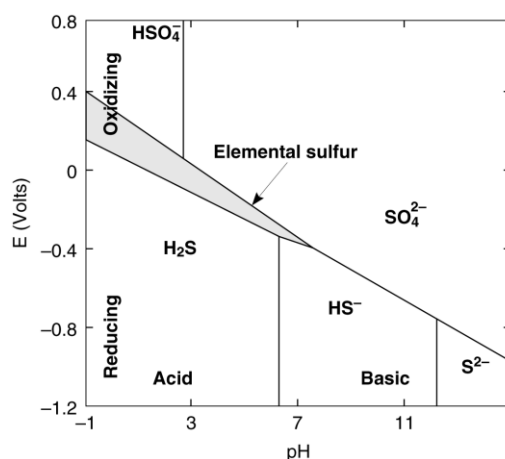


Figure 2. Formation of elemental sulfur during oxidizing sulfide ores at 100°C

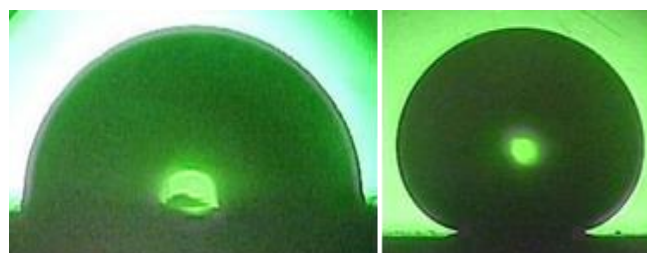


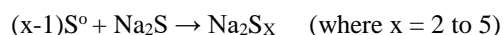
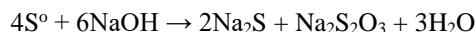
Figure 3. Left: Molten sulfur covers sulfide surface in absence of surface active agent. Right: Molten sulfur does not cover sulfide surface in presence of surface active agent

SPECIAL CASES

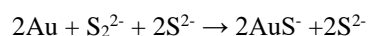
Sulfides containing gold

Sulfide ores may contain gold embedded in the sulfide matrix and as a result many gold producers treat such ores at high temperature to liberate gold then treating the residue containing gold by cyanidation to recover gold.³ It was found that gold will be associated with the sulfur.

Jeffrey and Anderson⁴ and Anderson and Twidwell⁵ found that sulfur formed agglomerates containing all the gold as well as unreacted sulfides. Cyanidation of these agglomerates was not effective in recovering gold but sodium sulfide was. This can be conducted by leaching the agglomerates in sodium hydroxide whereby sodium sulfide was formed:



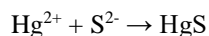
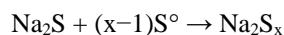
Gold dissolution was the result of leaching by polysulfides and sulfides:



Gold was recovered from solution by including electrowinning, gaseous precipitation, chemical precipitation, cementation, solvent extraction and ion exchange.

Sulfides containing mercury

Jorjani and Ghahreman⁶ reported that if mercury is present in the ores the elemental sulfur will contain the mercury and this can be leached by sodium sulfide to free it from mercury by forming insoluble mercury sulfide while elemental sulfur forms soluble polysulfide:



In conclusion, it is obvious therefore that elemental sulfur obtained during oxidative leaching of sulfides will contain mercury and gold and both can be effectively recovered using sodium sulfide.

CONCLUSION

While metals in sulfide ores go in solution as elemental sulfur forms, gold and mercury are embedded in the sulfur and can be recovered by leaching with sodium sulfide provided a surface active agent is present.

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