goldmining

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Gold Mining Electronic Wastes with Supercritical CO2 Publications

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Gold mining with Supercritical CO2 extraction from electronic wastes and publications related to supercritical CO2 extraction.

PDF Version of the webpage (first 10 pages)

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Under development as of 3/11/2021

We are currently updating this page and subject.

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Publications on Supercritical CO2 Recycling and Industrial Waste Precious Metal Mining and Recovery

Gold mining with supercritical CO2.

Precious metals including copper, gold, and palladium can be dissolved in supercritical CO2 by oxidation. This supercritical fluid dissolution technique provides a dry method for recovering precious metals from abandoned electronics and spent catalysts with minimum waste generation.

Currently, increasing amounts of end-of-life (EoL) electronic products are being generated due to their reduced life spans and the unavailability of suitable recycling technologies. In particular, waste printed circuit boards (PCBs) have become of global concern with regard to environmental issues because of their high metal and toxic material contents, which are pollutants. There are many environmental threats owed to the disposal of electronic waste; off-gasses, such as dioxins, furans, polybrominated organic pollutants, and polycyclic aromatic hydrocarbons, can be generated during thermal treatments, which can cause serious health problems if effective off-gas cleaning systems are not developed and improved. Moreover, heavy metals will dissolve, and release into the ground water from the landfill sites. Such waste PCBs contain precious metals which are of monetary value. Therefore, it is beneficial to recover the metal content and protect the environment from pollution. Hydrometallurgy is a successful technique used worldwide for the recovery of precious metals (especially gold and silver) from ores, concentrates, and waste materials. It is generally preferred over other methods because it can offer high recovery rates at a relatively low cost. This article reviews the recent trends and developments with regard to the recycling of precious metals from waste PCBs through hydrometallurgical techniques, such as leaching and recovery.

Supercritical fluids, especially those based on inert substances, are considered as clean solvents, free from the environmental concerns of disposal, handling and toxicity associated with organic solvents. A pure supercritical fluid is a substance above its critical temperature and pressure.

Technological development and intensive marketing support the growth in demand for electrical and electronic equipment (EEE), for which printed circuit boards (PCBs) are vital components. As these devices become obsolete after short periods, waste PCBs present a problem and require recycling. PCBs are composed of ceramics, polymers, and metals, particularly Cu, which is present in highest percentages. The aim of this study was to develop an innovative method to recover Cu from the PCBs of old mobile phones, obtaining faster reaction kinetics by means of leaching with supercritical CO2 and co solvents.

It is this solvating power that makes supercritical fluids useful in such processes as the decaffination of coffee and in the extraction of many important industrial chemicals including medicinal compounds, natural oils and flavors and even, organic pollutants.

Recent work at the Bureau of Mines showed some unique and potentially useful results when refractory gold ores were pretreated with supercritical water before standard leaching. This work is described below. Because the work was exploratory, this paper is a status report; much more research is needed to judge whether the technology is commercially feasible.

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