Recycling of Composite Metallic Coatings

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Relevant topics: (1) Emerging Recovery & Recycling Technologies; (2) Innovative Remanufacturing Technologies

Abstract

Recycling of bimetallic composite coatings presents challenging opportunities as both the alloy substrates and coatings contain valuable resources for recovery and reuse. Several composite bimetallic layers have been investigated and their separation processes optimized. Four such combinations include tantalum coated high temperature steel substrate, niobium coated tool steel, tin coated iron and nichrome coated stainless steel that have been investigated. Various combination of pyrometallurgical and hydrometallurgical techniques have been successfully applied to separate the composite layers. Optimized process conditions shall be presented for tantalum coated steel and tin coated iron.

Tantalum is a refractory metal with low recycling rate of less than 1% because most tantalum secondary recovery techniques are primarily meant for recovery of other elements. The main factor for selecting the best recovery method is dependent on the materials which are mechanically or chemically bonded with tantalum. This paper summarizes various methods to recover tantalum from different secondary sources like tantalum capacitors, tantalum mill products, and tantalum in chemical processing industry. The best method to recover tantalum from tantalum coated steel has been discussed

One of the key secondary resources for metallic tin is tinplated cans, which account for 25% of the domestic apparent consumption of tin. The recovery processes for recovering tin from tinplated metal cans are primarily electrochemical (electroplating and electrowinning) and chemical (leaching) techniques. In this study, one-step electrolytic detinning and two-step leaching and electrowinning processes for tin extraction in alkaline based solvents are reviewed and optimized for several process parameters. The Anodic polarization behavior of pure bulk tin and tinplated steel anodes is studied for its active-passive characteristics in various alkaline based medium in the presence of oxidizing and reducing agents, and polarization parameters are summarized. Additives like potassium iodate as oxidizing agent increases the tin dissolution rate and metallic aluminum additive as reducing agent increases the electrodeposition rate in sodium hydroxide based medium.