

Hybrid Recovery of Copper and Silver from Photovoltaic Ribbon and Ag finger of End-Of-Life Solar Panels

Authors : T. Patcharawit, C. Kansomket, N. Wongnaree, W. Kritsrikan, T. Yingnakorn, S. Khumkoa

Abstract : Recovery of pure copper and silver from end-of-life photovoltaic panels was investigated in this paper using an effective hybrid pyro-hydrometallurgical process. In the first step of waste treatment, solar panel waste was first dismantled to obtain a PV sheet to be cut and calcined at 500°C, to separate out PV ribbon from glass cullet, ash, and volatile while the silicon wafer containing silver finger was collected for recovery. In the second step of metal recovery, copper recovery from photovoltaic ribbon was via 1-3 M HCl leaching with SnCl₂ and H₂O₂ additions in order to remove the tin-lead coating on the ribbon. The leached copper band was cleaned and subsequently melted as an anode for the next step of electrorefining. Stainless steel was set as the cathode with CuSO₄ as an electrolyte, and at a potential of 0.2 V, high purity copper of 99.93% was obtained at 96.11% recovery after 24 hours. For silver recovery, the silicon wafer containing silver finger was leached using HNO₃ at 1-4 M in an ultrasonic bath. In the next step of precipitation, silver chloride was then obtained and subsequently reduced by sucrose and NaOH to give silver powder prior to oxy-acetylene melting to finally obtain pure silver metal. The integrated recycling process is considered to be economical, providing effective recovery of high purity metals such as copper and silver while other materials such as aluminum, copper wire, glass cullet can also be recovered to be reused commercially. Compounds such as PbCl₂ and SnO₂ obtained can also be recovered to enter the market.

Keywords : electrorefining, leaching, calcination, PV ribbon, silver finger, solar panel

Conference Title : ICENS 2022 : International Conference on Environment and Natural Science

Conference Location : Zurich, Switzerland

Conference Dates : January 14-15, 2022