Total recycling of valuable metals from spent auto-catalyst

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The cordierite ($2MgO{\cdot}2Al_2O_3{\cdot}5SiO_2$), the substrate of auto-catalysts is generally coated with the thin layer of γ- Al_2O_3, which also contains the PGMs (Pt, Pd and Rh) as active material and a mixture of additives (oxides of Ce, Zr, La, Ni, Fe and alkaline-earth). The recycling of PGMs from the spent auto-catalysts is becoming extremely attractive as compared to the primary resources due to the higher contents of PGMs, with several advantages such as simpler process, lower cost, and lesser environmental pollution. For decades the pyrometallurgical recycling processes have been employed to extract PGMs from the spent auto-catalyst. Though the pyrometallurgical processes are highly efficient to recover PGMs, but they can't recover other metal components. In view of the depletion of primary resources and climate changes associated with the gaseous emissions, new strategies are required particularly to recycling all valuable components. The hydrometallurgical routes may offer such possibilities ensuring the recovery of almost all the metals from the spent auto-catalyst, but require aggressive acidic conditions and oxidants in high concentrations. In order to develop an efficient and environmentally friendly approach, we have investigated a new hydrometallurgical process for the total recycling of other metal components as well as PGMs from the spent auto-catalyst. The cordierite substrate of the auto-catalysts was decomposed to dissolve aluminum and magnesium using NaOH roasting and H_2SO_4 leaching, leaving PGMs and cerium oxide in the residue. PGMs were recovered to the extent of 99% by cementation with Al whereas cerium oxide was recovered up to 90% by hot digestion using H_2SO_4. The hydrometallurgical process described in this study has a potential for sustainable utilization of wastes to recycle all the metals.

Speaker Biography

Jae-chun Lee is currently Distinguished Principal Researcher in the Mineral Resources Research Division at the Korea Institute of Geo science and Mineral Resources (KIGAM) and a campus representative professor in the Department of Resources Recycling at the Korea University of Science & Technology. Lee received his B.S. in metallurgical engineering, M.S. and Ph.D. in Hydro metallurgy from Hanyang University, Korea. His research deals with leaching, separation and purification of metals from primary and secondary resources and material preparation by aqueous processing. His current research focuses on the recycling of valuable metals from urban mine by hydro metallurgical routes. He has authored over 200 articles. He is currently an Associate Editor of Hydrometallurgy.

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