Understanding of chemical and catalytic mechanism of oxidative precipitation process applied for lithium ion batteries metal recovery

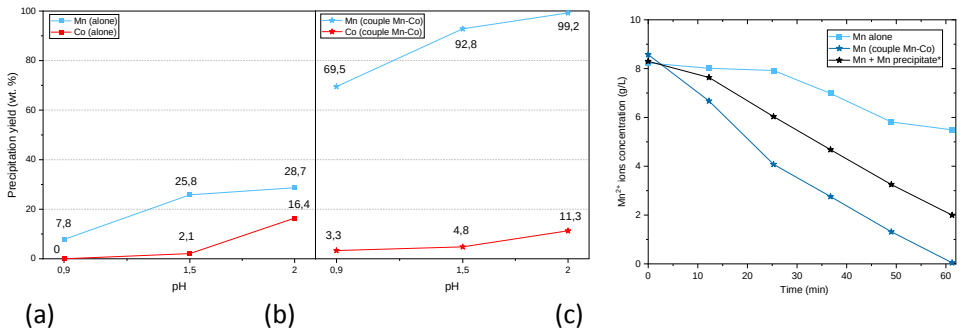
Roberto BARBANO, Emmanuel BILLY, Gaëlla FRAJER, Hervé MUHR*

Université Grenoble Alpes, CEA, LITEN, 38000 Grenoble, France

** emmanuel.billy@cea.fr*

Abstract :

Hydrometallurgical processes have emerged as effective solutions for enabling a closed recycling cycle of valuable metals from Lithium ion batteries. Nevertheless, the complexity of current process plants, coupled with the high economic and environmental impacts of solvents used for Liquid/Liquid (L/L) extraction has led to the development of new strategies. The study aims to separate manganese and cobalt by oxidative precipitation [1], using PMS (Peroxymonopersulfate couple HSO_5^-/SO_4^{2-}). The concept involves a simple, solvent-free process, with no use of chlorine-based species to selectively recover manganese and cobalt. Precipitation tests of Mn and Co together were conducted, in presence of PMS, to highlight the role of Co^{2+} ions. Indeed, selectivity and precipitation yield are strongly affected by pH and Co^{2+} ions. As presented in Figure 1 (b), the precipitation yield and selectivity to Mn increase significantly near pH 0.9. In addition, under specific pH conditions, as illustrated in Figure 1 (c), the introduction of the precipitate resulted in enhanced process kinetics. The roles of cobalt and PMS were further investigated as a function of pH and temperature, revealing significant performance variations and microstructural evolutions of the precipitated product. This study highlights a complex precipitation mechanism, whose control enables the achievement of high efficiency and purity in the precipitated elements.



(a) (b) (c)

Figure 1 (a-b) Precipitation yield of Mn vs pH; (c) kinetics of precipitation of Mn at fixed pH of 2.

1. Emmanuel Billy; Sandrine Barthelemy, "Procédé de recyclage des batteries li-ion FR3102008A1.pdf," 2019.