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Xiaoli Xi, Xiangjun Xiao, Zuoren Nie, Liwen Zhang, Liwen Ma



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Electrolytic separation of cobalt and tungsten from cemented carbide scrap and the electrochemical behavior of metal ions

Xiaoli Xi, Xiangjun Xiao, Zuoren Nie, Liwen Zhang, Liwen Ma

College of Material Science and Engineering, Beijing University of Technology, Beijing 100124, China

To whom correspondence should be addressed: Zuoren Nie; E-mail: zrnie@bjut.edu.cn;

Tel/Fax:86-10-67391536

Abstract

Molten salt electrolysis is used to separate and recycling of elemental tungsten and cobalt from cemented carbides. WC-6 wt% Co scrap and NaCl-KCl molten salt was used as a sacrificial anode and electrolyte, respectively. The range of preparation parameters and the electrochemical behavior of tungsten and cobalt ions were investigated through electrochemical techniques, such as cyclic voltammetry (CV) and square wave voltammetry (SWV). Results showed that the dissolution potential of cobalt and WC were 0 V and 0.6 V (vs. Ag/AgCl), and the reduction potentials of Co(II) + 2e⁻ ↔ Co (0) and W(II) + 2e⁻ ↔ W (0) were -0.2 and 0.2 V (vs. Ag/AgCl), respectively. The reduction processes of Co(II) to Co and W(II) to W were both reversible reactions controlled by ion diffusion. The average diffusion coefficients of Co(II) and W(II) were determined by CP to be 5.62×10^{-5} and $3.94 \times 10^{-5} \text{ cm}^2 \text{ s}^{-1}$,

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