Preliminary study on preparation of ammonium metatungstate from ammonium tungstate solutions using bipolar membrane electrodialysis

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Abstract: A novel process for the preparation of ammonium metatungstate (AMT) from industrial ammonium tungstate solutions using bipolar membrane electrodialysis (BMED) was developed. The preliminary study results showed that the BMED process can be used to effectively prepare the AMT solution from the $(NH_4)_2WO_4$ solution with the current efficiency of 73.8%. The direct recovery of WO_3 reached 99.5% with the power consumption only 864.3 KWh/t WO_3. The obtained AMT solution can be directly used to produce the AMT crystal. The solubility of the final AMT product reached 650 g AMT per 100 g H_2O at 25 ℃, which meets the Chinese national standard on the preparation of petrochemical hydrodesulfurization catalysts. The new process exhibits significant advantages including short flow sheet, low energy consumption, high recovery of WO_3 and high quality of product, and environmental friendliness.

keywords：Ammonium metatungstate; Ammonium tungstate; Bipolar membrane; Electrodialysis

1. Introduction

Ammonium metatungstate (AMT) with chemical formula of $(NH_4)_6(H_2W_{12}O_{40})\cdot nH_2O$ is an ammonium isopolytungstate (Zhang and Zhao, 2005). It is regarded as a petrochemical product for the preparation of W-series hydrodesulfurization catalysts because of its large molecular weight and high water solubility of over 300 g AMT per 100 g H_2O at 25 ℃ (Zou, 1992).

The methods to prepare AMT include solid and liquid phase conversions. For the method of solid phase conversion, the traditional process with thermal decomposition of ammonium paratungstate (APT, $(NH_4)_{10}(H_2W_{12}O_{42}]\cdot 4H_2O$) crystals is currently used as the main process to produce AMT in the industry (Carpenter and Laferty, 1985). In this process, the APT crystals are firstly decomposed to generate amorphous state of AMT by controlling temperature, partial pressures of ammonia and water, following by leaching with hot water, adjustment of pH to 3~4 and evaporation to produce the AMT crystals. Although the final product with good quality can be obtained, the drawbacks of this method are long flow sheet, low direct recovery of WO_3 (< 85%), relatively low thermal

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