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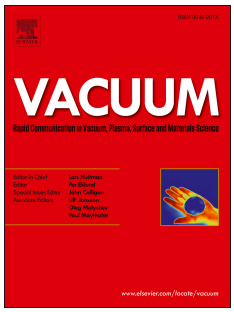

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Application of vacuum distillation in refining crude lead

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ABSTRACT： This paper introduces a new process for refining crude lead by vacuum distillation. The saturated vapor pressures of lead and impurity elements were calculated, and the removal effect of impurity elements was quantitatively predicted using the vapor-liquid equilibrium diagram. In addition, the low temperature followed by high temperature vacuum distillation method and the high temperature followed by low temperature method were adopted to adjust the order of impurity removal. The refining effect was experimentally studied using these two methods, and the best parameters were determined. The predictions are in close agreement with the experimental results. Based on theoretical and experimental analyses, a new, clean and efficient process for refining crude lead was developed. First, the crude lead was distilled by vacuum distillation at 10 Pa and 1673 K for 30 min, and then, the volatiles and residues were collected. Second, the volatiles were vacuum distilled at 10 Pa and 1273 K for 30 min. The removal rates of Cu, Sn, Ag, Zn, Sb and Bi were 99.73%, 99.72%, 96.23%, 90.78%, 74.80% and 8.82% respectively, and the purity of Pb reached 99.03%.

keywords： crude lead; vacuum distillation; refining

1. Introduction

Crude lead contains a certain amount of Cu, Sn, Ag, Zn, Sb, Bi and other impurities. The wide use of lead is limited by the impurities, and it must be refined to remove them. [1] At present, the fire refining process and electrolytic refining process are widely used in refining crude lead, the former accounting for approximately 70% of worldwide processing. Fire refining cannot be done in one step, and each impurity is to be removed separately; therefore, it has some disadvantages, such as a complex procedure, a low direct rate of lead, and evident environmental pollution [2-3]. Ban et al. [4] found that through addition of PbS, the removal of Cu decreased from 0.814% to 0.011, and the removal rate was 98.65%; Xu et al. [5] found that through the oxidation of Sn, the removal rate was 98%, and through the alkali method in addition to Sb, the removal rate