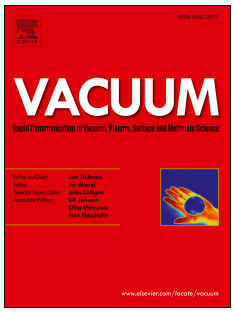
# Accepted Manuscript




Thermodynamic calculation and experimental investigation on the dissociation of lead sulfide under vacuum

Zhengen Zhou, Heng Xiong, Xiumin Chen, Dachun Liu, Bo Zhang, Yongwei Zhang

PII: S0042-207X(18)30198-2

DOI: 10.1016/j.vacuum.2018.04.041

Reference: VAC 7946

To appear in: *Vacuum*

Received Date: 3 February 2018

Revised Date: 25 April 2018

Accepted Date: 26 April 2018

Please cite this article as: Zhou Z, Xiong H, Chen X, Liu D, Zhang B, Zhang Y, Thermodynamic calculation and experimental investigation on the dissociation of lead sulfide under vacuum, *Vacuum* (2018), doi: 10.1016/j.vacuum.2018.04.041.

# Thermodynamic calculation and experimental investigation on the dissociation of lead sulfide under vacuum

1.National Engineering Laboratory for Vacuum Metallurgy, Kunming University of Science and Technology, Kunming 650093, China
2.Faulty of Metallurgical and Energy Engineering， Kunming University of Science and Technology,
3.Yunnan Provincial Key Laboratory of Nonferrous Vacuum Metallurgy, Kunming 650093, China
Zhengen Zhou, Heng Xiong*, Xiumin Chen, Dachun Liu, Bo Zhang, Yongwei Zhang,

## Abstract

Lead sulfide is the main raw material employed to produce lead. And it is believed to be a very stable substance. The dissociation pathway of lead sulfide is believed to be 2PbS=2Pb(l)+S2, and its initial dissociation temperature at 10 Pa is believed about 1273K, and there is no report that it could directed dissociate into lead and sulfur. In this work, we theoretically calculated the stability of lead sulfide at the pressure of 10 Pa, and experimentally investigated the dissociation product of lead sulfide. The first part of this article investigated the dissociation pathways of lead sulfide based on thermodynamic calculation. The second part studies the dissociation as well as volatilization product using X-ray diffraction, ICP-AES and SED. The result indicated we could obtain lead from the direct dissociation of lead sulfide, and the dissociation pathway is 2PbS (g) =2Pb(l)+$S_2$. At 1153K, the decomposition rate is 42.71%, and the purity of lead is 99.9%.

**Key words:** lead sulfide, vacuum, dissociation, XRD, residual, condensate

## 1. Introduction

Lead is not found in nature as a free element, but rather, is predominantly found in the earth’s crust in the form of galena (PbS). And lead sulfide is the main raw material employed to produce lead. Almost all the lead is produced from galena through pyrometallurgical process, including oxidation-reduction smelting process, reaction smelting process and precipitation smelting process. The purity quotient of lead produced from pyrometallurgy range from 96% to 99% [1-4]. Most