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Extraction and Purification of Zinc from Industrial Wastes of the State Company for Electrical Industries in Al-Wazeria, Baghdad-Iraq

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Abstract: ***In this research, high purity extract zinc from the dross resulting from the General company for electrical Industry one of the formations the ministry of Industry and Minerals manner in thermal using salts are available in the country to remove toxic metals from the environment after smelting dross in crucible an iron lined oxide calcium and sodium silicate. It has been examining and analyzing the zinc of this process, several techniques (X-Ray Diffraction, X-ray fluorescence, flame and flameless atomic absorption). It has been running all tests and analyzes in the General Company for geological Survey and investigation metal X-Ray Department and the Ministry of Science and technology, Department of Chemistry and Materials.***

Keywords: Zinc, Dross, Extraction, iron, Lead

1. Introduction

Zinc metal is a slivery white, it has relatively low melting point (420^0C) and when it is pure have resistance and hardness higher than tin and lead and less than aluminum and copper [1]. Pure zinc be fragile at normal temperature, but be compliant at temperature higher than 100^0C be easy forming and private acts of rolling [2]. Layout crystalline zinc hexagonal (a=2.6594, c=4.9370). zinc is characterized by the following mechanical properties: the relative elongation=40-50%. The weight of prominence on the network and easily machined extruded at $250\text{-}300^0$C easy in forming molds and rolling at $130\text{-}170^0$C also can be formed by dragging at during the formation process of increasing plasticity zinc. The durability and hardness are decreasing. After cold rolling properties of zinc and its alloys vary depending on the direction of measurement result to form a crystalline pattern that is, it becomes anisotropic, the durability of zinc in the direction vertical to the direction of rolling [3]. The lead, tin and cadmium impurities harmful help occurrence of corrosion between the crystals. Iron leads to increased durability of zinc. When the iron content of more than 2% zinc becomes extreme brittleness. Tin and zinc eutectic easy melting (199^0C). This eutectic separated on the border between the grains and makes plastic deformation hot more difficult [4].

2. Experimental

1) Initialized dross resulting from the process for electrical industries in Al-Wazirya.
2) The dross was examined by several techniques and the determination of the percentage of impurities accompanying of zinc.
3) The iron crucible was lined with calcium carbonate and 1% sodium silicate.
4) The mixture was prepared of 40% calcium chloride, 30% sodium chloride and 30% ammonium chloride, added 7-10% from the above mixture to it at 450^0C in the electrical furnace with stirring of molten for 3 minutes after melting process.
5) Add mixture of 1% sodium fluoride or calcium fluoride and 1% sodium thiosulphate and 1% sodium citrate then rise the temperature of molten to 650^0C with continuous stirring for two minutes and then remove the slag from the molten surface.
6) Zinc has been pouring in graphite or an iron molds lined by calcium carbonate and 1% sodium silicate.

3. Results and Discussion

Assays were carried out in several different techniques (X-ray fluorescence, X –ray diffraction and atomic absorption spectrophotometer) to checking purity zinc and impurities accompanying the zinc before and after the extraction of zinc which were illustrated in tables (1) and (2). The figures (1), (2) and (3) show quantities and qualitative of the purity of zinc. Table (3) shows the quantities analysis of zinc before and after the extraction process which is indicated the reducing of the iron, lead and other impurities to less than what can be less so that they are within the required specifications in the process hot galvanized. It has been getting high purity zinc extracted more than 99% (i.e. 99.995%). The samples (2, 6) reduced the percentage of the iron to less what can be less by the addition of 0.5-0.85 sodium citrate to 1%, the iron removal completely [5] see sample (7) and also was reduced the percentage of lead with adding 1% sodium thiosulphate [6], the remaining samples from 1 to 6 were added 0.2% calcium fluoride was added to remove the silicon from the dross according to the analysis of chemistry center, ministry of science and technology.
The mixture salts (calcium, sodium and ammonium chlorides) were added to the molten to remove the remaining of impurities [7] and they used as assistant smelting and zinc oxidation inhibitor [8]. All the analyses were carried out at the center of chemistry, Ministry of Science and Technology and x-ray department, the company of geological survey and mineral.

Table 1: The analysis of dross

Element	*Concentration*
K	1 ppm
Ca	0.6 ppm
Ti	0.5 ppm
Mn	0.7 ppm
Fe	7%
Cu	1 ppm
Zn	33%
As	5 ppm
Pb	4.1%
Cd	0.1%

Table 2: The analysis of pure zinc by X-ray diffraction

I (C/Sec)	*2Θ*	*D*
732	31.2	2.85
2000	36.39	2.40
1502	39.01	2.30
2000	43.41	2.08
1305	54.81	1.68

Where: I=intensity, 2Θ= Brag angle d= plane spacing

Table 3: The percentage of extracting zinc and the impurities before and after the extraction process

Sample	*Zn%*	*Pb%*	*Fe%*	*Cd%*
Dross	33%	4.1%	7%	0.1%
1	99.2	0.28%	0.23%	-
2	99.3%	0.30%	0.03%	-
3	99.15%	0.29%	0.11%	-
4	99.07%	0.33%	0.25%	-
5	99.3%	0.31%	0.11%	-
6	99.82%	0.25%	0.013%	-
7	99.995%	0.004%	-	-

Samples from 1 to 7 after zinc purification.

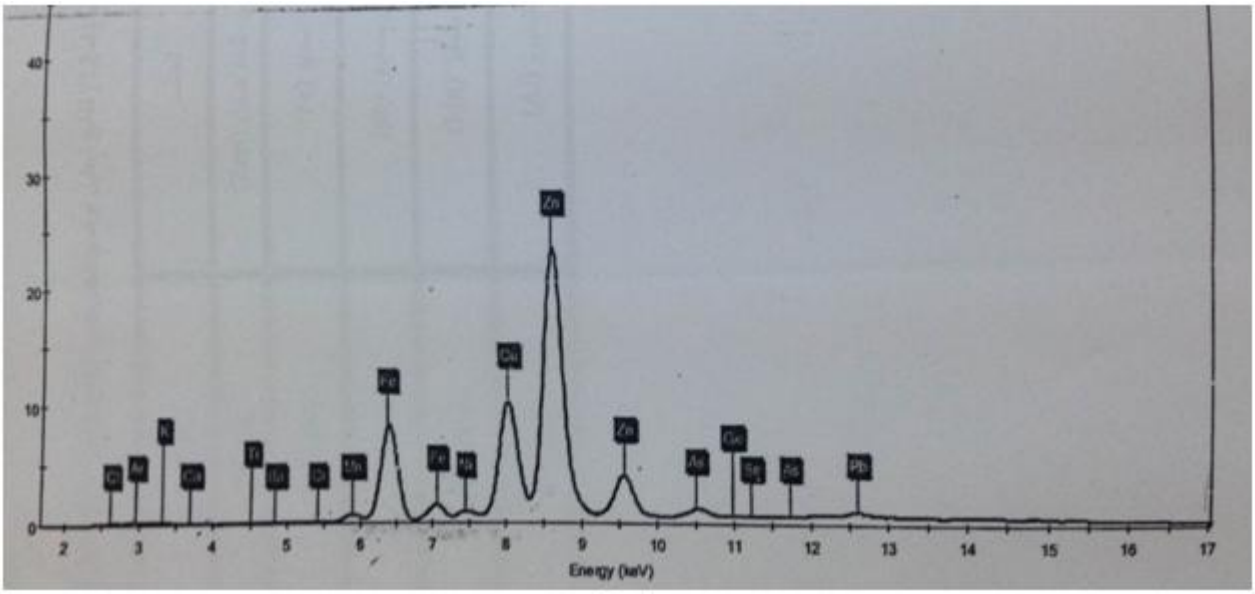

Figure 1: XRF of dross

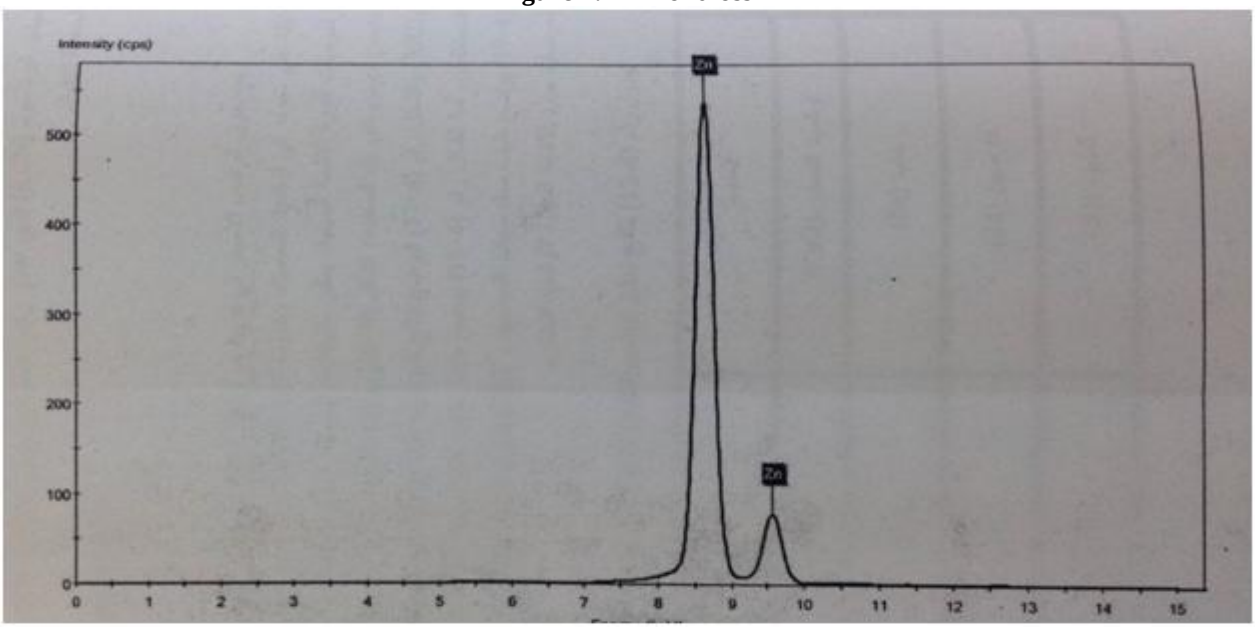

Figure 2: XRF of pure zinc

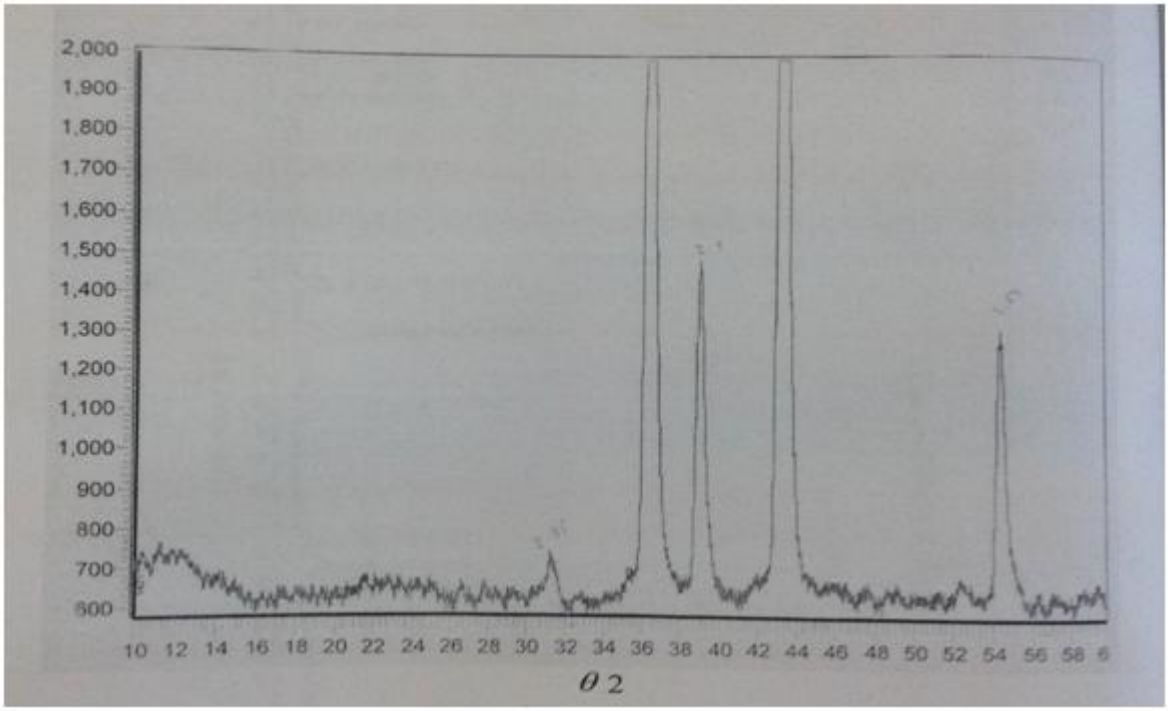

Figure 3: XRD of pure zinc

4. Conclusions

1) This method can use for all the ore containing high and low concentrations of zinc.
2) This method used was efficient in extracting zinc, economic and non-loss in the amount of zinc.
3) The main disadvantages of the roads referred to in the references it is high cost and the crooked places short lived.

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