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Assessment of selective sequential extraction procedure for determining arsenic partitioning in copper slag

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Supporting information

The arsenic oxide (As_2O_3) was prepared using the arsenic cake from the acid system of Tongling Nonferrous Metals Group, Jinlong Company. The major components in arsenic cake are arsenic sulfides. When the arsenic sulfides were dissolved in hot $CuSO_4$, the S^{2-} can react with Cu^{2+} to form CuS precipitates and the As sulfides can transform into As_2O_3 which is dissolved in solution. The As_2O_3 can be obtained from the solution after filtration and deep cooling. The XRD pattern of the prepared As_2O_3 is shown in Fig. S1.

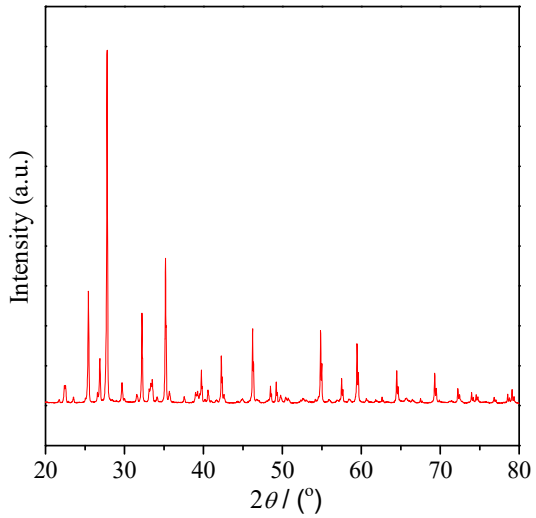

Fig. S1 XRD pattern of the prepared As_2O_3

Magnesium arsenate was prepared using $MgSO_4·7H_2O$ and $Na_2HAsO_4·7H_2O$ (purchased from Jinjinle (Hunan) Chemical Co. LTD) as reagents. Firstly, 1.70 g of $Na_2HAsO_4·7H_2O$ and 0.45 g of $NaHCO_3$ were dissolved in 100 mL of pure water and 2.00 g of $MgSO_4·7H_2O$ was dissolved in another 100 ml of deionized water. Then the two solutions were mixed and reacted to form an amorphous precipitates. After aging for 24 h, $Mg_3(AsO_4)_2·8H_2O$ crystals (PDF00-033-0856) can be obtained (Fig. S2).

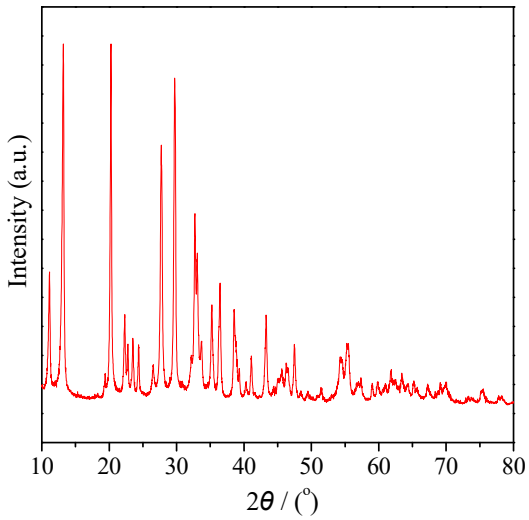

Fig. S2 XRD pattern of the prepared $Mg_3(AsO_4)_2·8H_2O$

$FeAsO_4·2H_2O$ was prepared using $Na_2HAsO_4·7H_2O$ and $FeCl_3$ with a molar ratio of 1:1 in pure water. Hydrochloric acid was added to control the pH at ~2.3. The solution was heated in water bath at 90 °C for 6 h. Then, a kind of gray precipitate $FeAsO_4·2H_2O$ (PDF00-037-0468) (Fig. S3) was obtained.

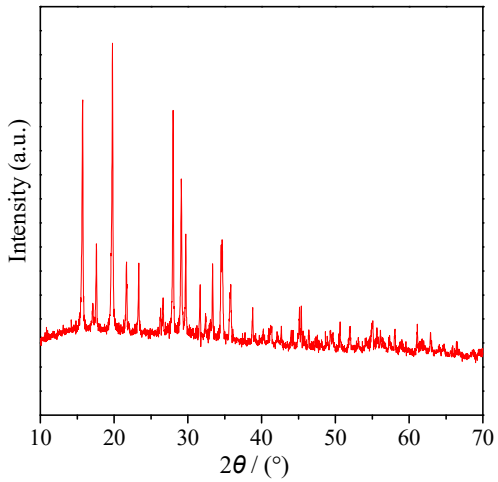

Fig. S3 XRD pattern of the prepared $FeAsO_4·2H_2O$

Arsenic sulfide was prepared using $Na_2HAsO_4·7H_2O$ and Na_2S. Excess Na_2S was added into the sodium arsenate solution to ensure the sufficient S^{2-}. The reaction process was carried out at 60 °C. Then, arsenic sulfide precipitations (Fig. S4) can be obtained. The minor elemental sulfur was removed by washing with CS_2.

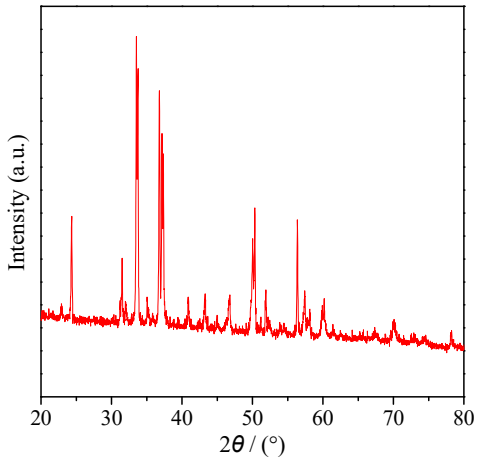

Fig. S4 XRD pattern of the prepared arsenopyrite

Arsenopyrite (FeAsS, PDF00-43-1470) is natural mineral provide by School of Metallurgy and Environment, Central South University.

Elemental arsenic was prepared via the reaction of Na_2HAsO_4 and $SnCl_2$. Firstly, 61g of $SnCl_2·2H_2O$ was dissolved in 300 ml of concentrated hydrochloric acid. Then, 20 g of Na_2HAsO_4 was added. Black amorphous arsenic was formed. The reaction can be described as follows :

$$2H_3AsO_4+10HCl+5SnCl_2 \rightarrow 2As\downarrow+8H_2O+5SnCl_4.$$

Copper-arsenic alloy was prepared through reactive synthesis using elemental arsenic and copper powder. Firstly, the Cu and As powders were evenly mixed at molar ratio of 3:1. Then, the mixture was put in a corundum crucible and sintered at 850 °C for 2 h in argon atmosphere. The XRD pattern indicates the product is nearly single phase Cu_3As (PDF01-074-1068) (Fig. S5).

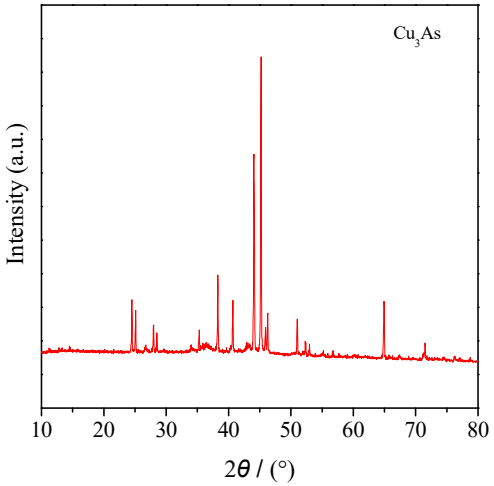

Fig. S5 XRD pattern of the prepared Cu-As intermetallic