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Effect of Temperature and Atmosphere on the Oxidation of Hardmetal Scrap

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1. Introduction

WC/Co Hardmetal is widely used for a variety of applications such as machining, cutting, drilling, and wear and corrosion resistive coating that has a very high cost. There is little research against the re-application of using cemented carbide the rare metal with a high price.

Recently, a new re-application technology of WC/Co Scrap was proposed by hard metal scrap direct oxidation and carburization of the WC/Co scrap. It will be able to effectively the fine WC/Co powder from the bulk scrap.

Oxidation was very important for the effective re-application of WC/Co scrap. In this study, the effect of the oxidation temperature and oxidizing atmosphere on the WC/Co scrap was investigated in the view on the re-application of the WC/Co scrap.

2. Experimental detail

The shape change of the WC/Co scrap during oxidation was observed using three kinds of scrap bulks : circumferences, 8footnotes and plate shapes. TGA analysis was carried out for knowing the effect of the oxidation condition on the oxidation of the K-grade WC/Co scrap.

The oxidation test from the prescribed below is at 1000°C of the heating rate for 5°C/min. and the weight change which it follows is in 12 hour maintenance it measures. At that time, the oxidation atmosphere is in air, Ar+50%O₂, 100%O₂ and the gas flow rate is 20cc/min with all conditions.

The oxidized bodies which follows in the prescribed temperature and the atmosphere were analyzed by XRD and SEM for microstructure and phase.

3. Results and discussion

The oxidation progress was dramatically increased when the temperature neared 700°C. An the early stage of oxidation it occured on the surface like general metal oxidation. The swelling of oxide layers and cracks on the WC-Co scrap were not related to their shapes. In the first stage the direction of the crack was progressed from the edge of the surface of the scrap to the inside. The shape of the breakdown of the oxide layer depend on the raw WC-Co scrap form. According to the oxidation progress, the weight increased after all the weight gain was saturated. The general average weight gain fraction on the WC-Co scrap was 120% of it's own weight in each condition of oxidation on the WC-Co scrap.

The 100%O₂ atmosphere is better than in air atmosphere on oxidation process.

The WC/Co scrap must be exposed in a high O₂ concentration oxidizing atmosphere for efficiently advanced complete oxidation in a short time.

After oxidation, if the sample was completely changed to oxide, there are no WC and Co x-ray diffraction peaks on the oxide.

The phases created by oxidation were CoWO₄ and WO₃, which are not related to oxidation temperature or oxidation atmosphere. The grain size of the oxide powder is more effectively in oxidation temperature than in oxidation atmosphere.

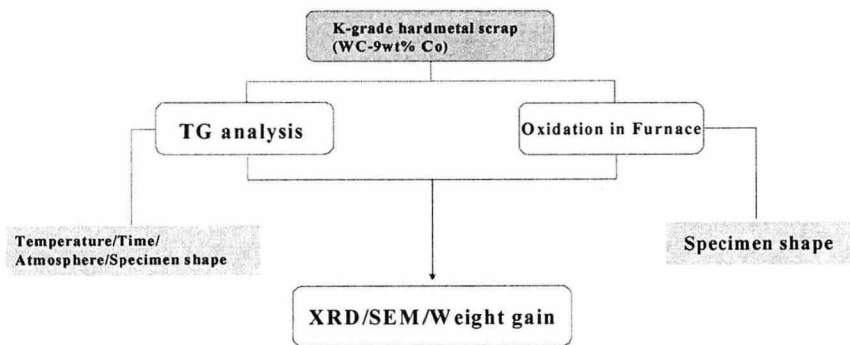


Fig. 1. Table of experiment progress.

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