

Erosive Wear Characteristics of WC Cast-in Insert Cast Irons on high temperature environment

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It's revealed that erosion rate increases due to hardness of matrix decreases on high temperature environment. As the countermeasure, this study was focused WC cast-in insert cast irons. This study investigated that erosive wear properties of WC cast-in insert cast irons on high temperature environment by a high temperature erosion test machine. Erosion rate of WC cast-in insert cast irons decreased in relations to base metal. Square shaped WC transverse-mounted 5Nb-5Co cast iron was showed excellent wear resistance. It's considered that hardness of matrix was showed the highest value and the relative hardness was increased by WC.

1. Introduction

Material surface damage due to powder fluid collision called erosive wear. Intense erosive wear in turning shot liner has occurred on high temperature environment. There is a need for a development of materials that exhibit excellent wear resistance. It's revealed that erosion rate increases due to hardness of matrix decreases on high temperature environment. As the countermeasure, this study was focused WC cast-in insert cast irons. WC Cast-in Insert Cast Irons has been reported to decreases of erosive wear properties on high temperature environment. This study investigated that erosive wear properties of WC cast-in insert cast irons on high temperature environment by a high temperature erosion test machine.

2. EXPERIMENTAL PROCEDURE

The test specimens for erosion test were high chromium cast irons (Hi-Cr) and multi-component cast iron (5Nb-5Co). Size of WC are $\phi 5 \times 50$, $\phi 8 \times$

50, $\square 8 \times 50$ mm. Erosion test used high temperature erosion test machine in Fig.1. Spherical shaped alumina particles with average diameter 1.16mm, Vickers hardness 1140HV were used in this study. The examined air speed was 100 m/s, and the particle speed was 30 m/s with changing their impingement angle 30, 60 degree respectively. Erosion rate was used to the evaluation of wear resistant.

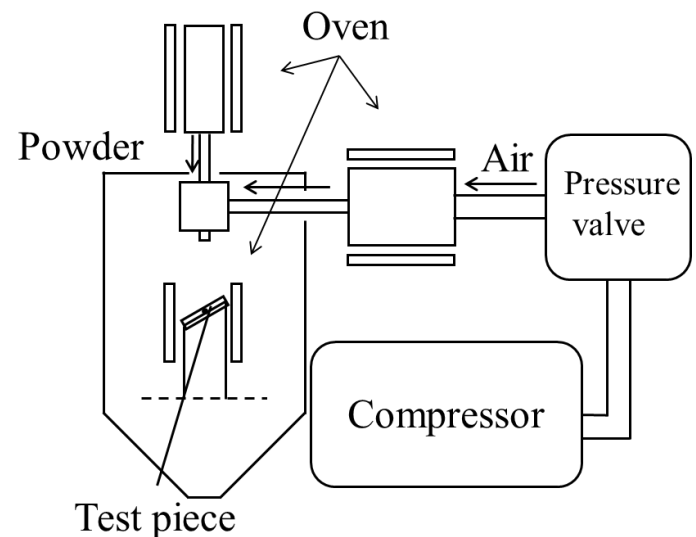


Fig. 1 high temperature erosion test machine

3. RESULTS AND DISCUSSIONS

Figure 2 and Figure 3 shows Erosion rate of WC cast-in insert cast irons decreased in relations to base metal. It's considered that hardness of matrix was showed the highest value and the relative hardness was increased by WC. Also, erosion rate of cylindrical shaped WC transverse-mounted cast iron and square shaped WC transverse-mounted cast iron decreased in relations to WC vertical-mounted cast iron and spherical shaped WC cast iron. It's considered area ratio of WC affected erosion rate. Square shaped WC transverse-mounted 5Nb-5Co cast iron was showed excellent wear resistance. Reaction layer base metal side harder than reaction layer WC side. From the result, It's significant for superior erosive wear resistance to formation reaction layer.

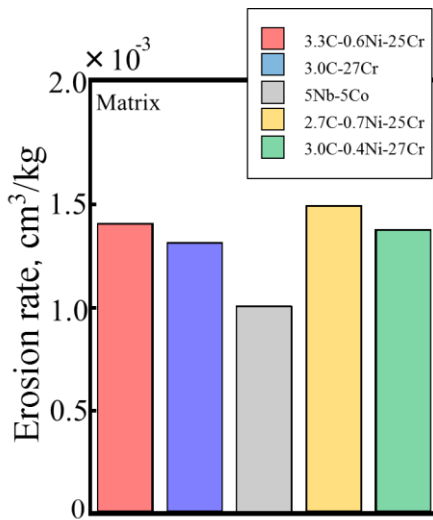


Fig. 2 Erosion rate of matrix.

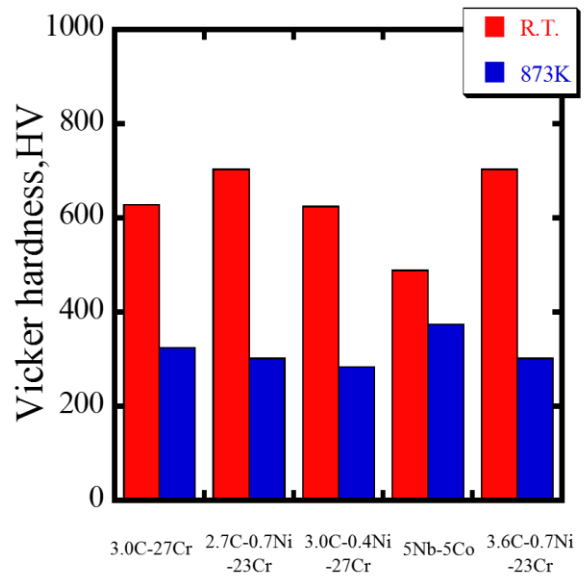


Fig. 4 Vickers hardness of Test material

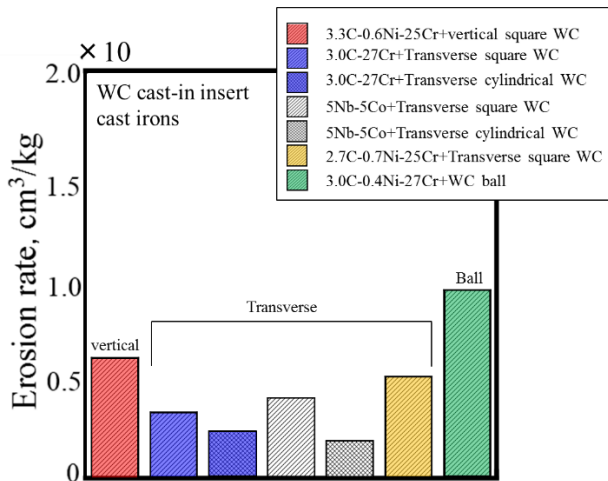


Fig.3 Erosion rate of WC cast-in insert cast irons.

Figure 4 shows Vickers hardness at 873K. Vickers hardness of 5Nb-5Co is higher than that of Hi-Cr. therefore, it's considered that Square shaped WC transverse-mounted 5Nb-5Co superior wear resistance. Also, between and WC base metal was observed. Wear depth of Square shaped WC transverse-mounted deeper than wear depth of cylindrical shaped WC transverse-mounted. Square shaped WC transverse-mounted 5Nb-5Co superior wear resistance. EDS surface analysis was performed detail in order to observe bonded surface of between WC and base metal in figure 5.

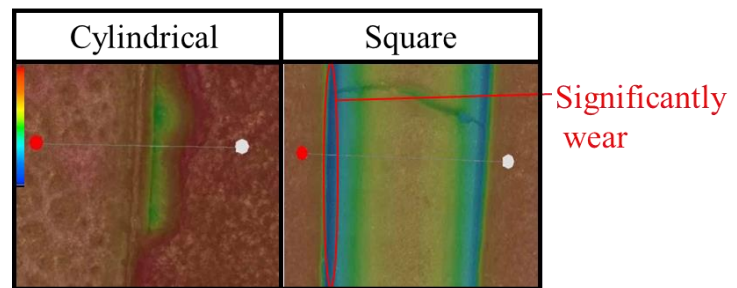


Fig.5 Profile result of microscope

4 CONCLUSIONS

- Erosion rate of WC cast-in insert cast irons decreased in relations to base metal. It's considered that hardness of matrix was showed the highest value and the relative hardness was increased by WC.
- Vickers hardness of 5Nb-5Co is higher than Vickers hardness of Hi-Cr cast iron. For that reason, erosive rate of Square shaped WC transverse-mounted 5Nb-5Co cast iron is highest.
- Then this study was tested on 873K, 1023K, 1173K. When the temperature is increase, erosion rate is increase and Vickers hardness is decrease. WC cast-in insert cast irons is a valid between 873K and 973K.