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THE INOCULATION EFFECT OF ALUMINUM ADDITION ON SELECTED HIGH-CHROME CAST IRON PROPERTIES

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Abstract

The presented work includes the subject of aluminum addition as inoculant to high-chromium cast iron, especially in the aspect of eliminating hot cracks and its impact on wear resistance, hardness and toughness.

1. Intruduction

High-chromium cast iron is widely used as a material with increased abrasion resistance in the steel, energy and mining industry.
One of the significant problems are hot cracks that appear during the foundry production process [1-6]. One of the ways to reduce this phenomenon is to modify the alloy by aluminum.

2. Methodology

The melts were carried out in industrial conditions. Liquid metal overheated to 1600°C in induction furnace. The liquid metal poured from furnace to ladle. Aluminum was carried out on the stream of liquid metal. The addition of aluminum was in the shape of rods with a diameter of 3 mm and a length of 5 mm.The following amount of aluminum have been used; 0.17% Al, 0.33% Al and 0.66% Al. Each time, an Althoff-Radke test (A-F) [7] was performed, fig. 1. and a mold containing, among other things, an impact test.

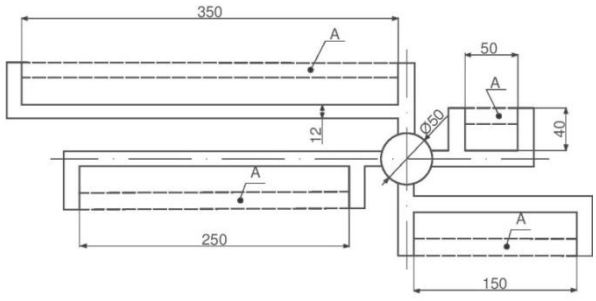


Fig. 1. A-F Hot cracking test, (A) - resistance rod

The research was carried out at the Department of Casting Engineering and Cast Composites at the Faculty of Foundry Engineering. Vickers hardness test, Charpie hammer and abrasion test device MAN company was used.

3. Results and discussion

The results of the Althoff-Radke test are shown in Fig. 2-5, selected microstructures in Fig. 6.

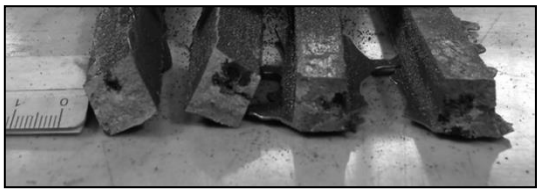


Fig. 2. A-F Hot cracking test for reference cast iron

Fig. 3. A-F Hot cracking test for 0.17% Al addition to cast iron

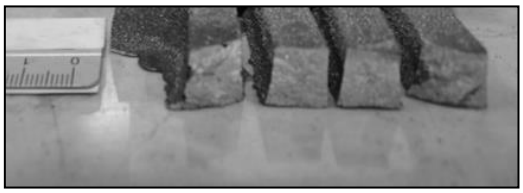


Fig. 4. A-F Hot cracking test for 0.33% Al addition to cast iron

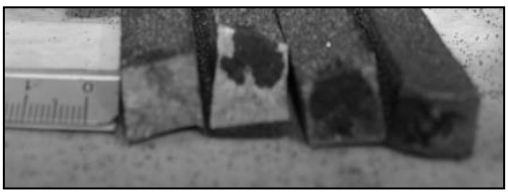


Fig. 5. A-F Hot cracking test for 0.5% Al addition to cast iron

a) b)

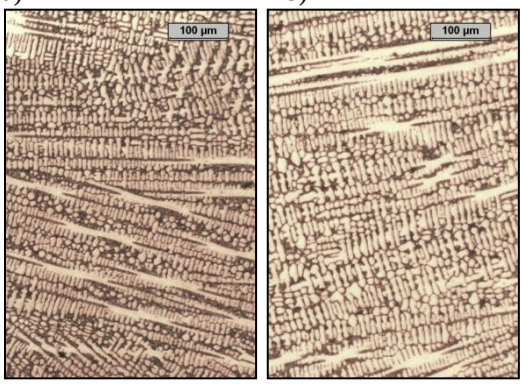
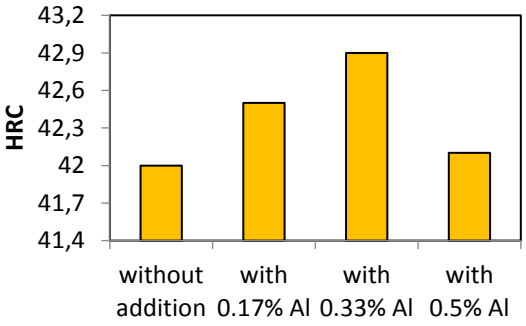


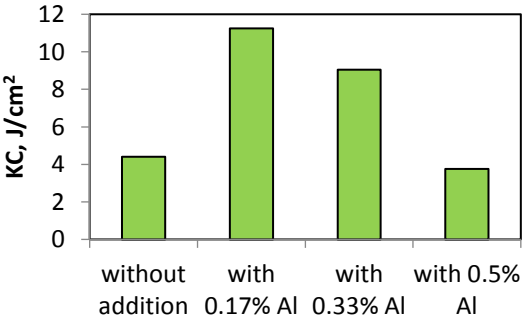
Fig. 6. Microstructure of high-chromium cast iron without - a) and with addition of 0.5% Al

Fig. 7 shows the test results obtained during the research.

a)



b)



c)

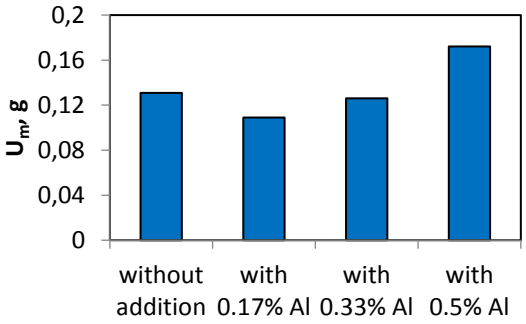


Fig. 7. Test results of high-chromium cast iron: HRC-toughness, impact resistance - b), weight loss during the abrasion resistance test – c)

4. Conclusions

The presented results show that the addition of aluminum has an impact on the reduction (addition of 0.17% and 0.5%) or elimination (0.33%) of hot cracks.

An increase in the hardness of the alloy was observed with each addition of Al. The highest values were obtained at 0.17 and 0.33%.

The impact strength in the case of the 0.5% addition decreased compared to the initial sample, while at 0.17% and 0.33% the impact strength was more than twice as high.

In the case of abrasion resistance, its value at the first two doses (0.17 and 0.33%) of Al decreased to increase at 0.5% Al.

Acknowledgments
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