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学位論文題目	Corrosion Behavior of High-Carbon Martensitic Steel with Cu Addition
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論文内容要約

Chapter 1:

Due to their well mechanical properties, the high-carbon alloy steel system is widely used as the materials for manufacture equipment. However, in real conditions in production, the susceptibility of such materials to corrosion becomes a big non-negligible issue. This chapter introduce the high-carbon alloy steels as well as the corrosion-related studies. The motivation and objectives for this research will also be introduced.

Chapter 2:

When the alloy system was decided, the knowledge of the effect that how each alloying element affects the mechanical properties as well as corrosion performance of the current material is desired, which would be helpful for adjusting chemical compositions of alloys to obtain better properties of the alloys, in the aspects that we concerned. This chapter will present experimental results of hardness and corrosion performance of alloys using different combinations of alloying elements. Effect of alloying elements on hardness and corrosion resistance of the current alloy system can be determined, based on the experimental observations.

Chapter 3:

Conclusions that made from experimental observations might be one-sided sometimes. Although counterintuitive, it is appropriate to discuss the experimental dataset under an identical framework rather than using the respective subsets, due to that different subsets might have different ranges of variables. This chapter introduced a feasible approach to build the statistical model based on the complete experimental dataset instead of certain subsets. Most of the facts in this model should correspond the experimental observations.

Chapter 4:

After solution treatment followed by water quenching, the quenching hardness of Fe–CrW–Cu–C alloys have been confirmed. This chapter will present the related microstructural studies, in purpose to show the reason that result of quenching hardness, observed in Fe–CrW–Cu–C alloys.

Chapter 5:

In previous study, we have investigated the corrosion resistance of Fe–Cr–W–C–(Cu) alloys, effected by Cu addition. Many evidences were showed in the literature review in introduction that Cu addition can significantly improve the corrosion resistance of alloys in H_2SO_4 solution. However, the expected correlation between such corrosion performance and Cu content in Fe–Cr–W–C–Cu alloys has not been confirmed by the statistical model built based on the PCA. Because based on the previous literatures, it is still a strong belief that the difference in corrosion rates observed in current experiment was resulted from Cu addition. The discrepancy observed between experiment and statistical model requires further investigations. Instead of preparing more test alloys with various Cu content addition, the study in this chapter is mainly focused on the characterization on the samples with and without Cu addition after corrosion. Furthermore, the corrosion mechanism has also been analyzed. For the derivation of the conclusion, some statistical approaches were utilized.

Chapter 6:

Up to now, all the tests as well as microstructural observations were conducted based on the as-cast materials that were made from arc melting. However, due to their inhomogeneous microstructures, before practical usage, those materials should be processed using solution treatment followed by hot-forging. This chapter mainly focuses on the materials that were based on the hot-forged state. The experiments hereafter, are expected to be instructive for applying those materials in the practical industries.