UNIVERSITI TEKNOLOGI MARA
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MEC299

STUDY OF HARDNESS ON THE STAINLESS STEEL IN VARIOUS COOLING MEDIUM

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SEM MARCH AUGUST 2022

ABSTRACT

Due to its superior mechanical qualities when compared to other materials, stainless steel is utilised extensively in various fields; thus, its properties must be improved to keep up with modern trends. Designing high-durability and reliable constructions can increase the safety factor for items, ensuring the users' security. This research was done to find out how heat treatment affected the microstructure and hardness of heat-treated stainless steel. Stainless steel samples will be heated under varied temperature and soaking time conditions.

TABLE OF CONTENTS

CHAPTER 1
INTRODUCTION

1.0 Introduction

This project is experimental. The project aims to determine the effect on the hardness of stainless steel by using a Vickers hardness machine. It also involves three cooling mediums which are water, air and cooking oil.

1.1 Background of Study

Hardness is the ability to withstand surface indentation and scratching which is a metric that determines how well it can survive surface contact penetration. Hardness is probably the most poorly defined material property because it may indicate resistance to scratching, abrasion, resistance to the indentation or even resistance to shaping or localized plastic deformation.[1] Hardness is important from an engineering standpoint because resistance to wear by either friction or erosion by steam, oil, and water generally increases with hardness. The hardness test is a kind of quantitative test. The hardness value of the material is closely related to the type of microstructure in metallurgical research. Ferrite is a softer microstructure, while martensitic are more difficult microstructures. It was found that the applied indenter load is variable. It is aimed at determining what effect occurs during the hardness test of the material.[2]

There are many types of hardness tests that can be used among them, including the Vickers Hardness Test, the Brinell Hardness Test, the Rockwell Hardness Test and the Knoop Hardness Test. However, the appropriate force test used in this experiment is the Vickers Hardness Test. It is because the Vickers technique of hardness testing tries to measure a

material's hardness in terms of durability against a diamond identifier that is quite small and has a geometric shape in the shape of a pyramid. So, stainless steel microstructures can be seen more efficiently. In comparison to Rockwell and Brinell tests, which have a burden of 1 to 1000 grammes, the burden imparted is low. Vickers hardness testing employs only one sort of identification, a pyramid-shaped identity that may be used to test practically any metal, from soft to hard. [3]

Stainless steel is used in this study. Stainless steel is chosen because its resistance to high and low temperatures can be used in some applications. While some stainless steel will retain high strength at high temperatures other stainless steel will maintain high mechanical properties at cryogenic temperatures. Factors considered in this study are increased corrosion resistance capacity, surface roughness, and shine of stainless steel surface elements after Electrochemical Polishing (EP).[4] The reason why not to use materials other than stainless steel is that one of them is not a good resistant than stainless steel when subjected to high or even low temperatures. Stainless steel also has excellent mechanical and chemical properties.[5]

For cooling medium, it's only using only water, oil and air. These three mediums have different characteristic features. Water is a good cooling property. This is because water has a high specific heat capacity meaning it can absorb a lot of heat. Water can also absorb much of the heart of each particle without interruption, making it ideal to use as a cooling solution. It also must be nontoxic, or nonpoisonous. The evidence, from Alan Novendra et al. research, is that water should only take 10 minutes to cool a specimen at a temperature of 780°C.[6]

Oil, in turn, is usually used in the engine. The use of engine oil as a coolant, often to remove excess heat from an internal combustion engine, is known as oil cooling. The heat from the hot engine is transferred to the oil, which is then sent through a heat exchanger, commonly a form of radiator called as an oil cooler. The cooled oil circulates back into the hot