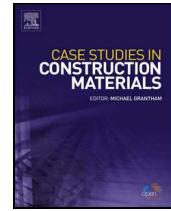




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Short communication

## Effect of aging process on the microstructure, corrosion resistance and mechanical properties of stainless steel AISI 204



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### ABSTRACT

In this study, the microstructure thermostability, corrosion resistance, and mechanical properties of AISI204 stainless steel after aging were investigated. The microstructural analysis showed precipitation of  $M_{23}C_6$  carbide along grain boundaries and its amount tends to increase with increasing aging time and temperature. Little effect of carbide precipitation on tensile strength where the maximum drop was at temperature 850 °C and aging time 48 h by 5.09%. At the same aging conditions, precipitation severely affected yield strength, ductility, and the microhardness. The yield strength decreased by 46% and microhardness to 210 HV. On the other hand, the ductility increased to 21% in terms of percent reduction in area. Weight loss as a result of uniform corrosion and corrosion current density were strongly dependent on aging time and temperature. Furthermore, Passivation current density showed independent behavior as the temperature increase.

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### 1. Introduction

The AISI204 is an austenitic stainless steel belongs to the 200 series, the chromium-manganese-nitrogen series as it's called. This series developed by American and German investigators by replacement part or all the most important austenite stabilizer which is nickel by other elements, when nickel prices have been relatively high over the early 1930s [1–3]. The existence of nitrogen in stainless steel grades especially these containing manganese has several advantages such as making them more strengthen, reducing the amount of nickel for maintaining austenite structure, decreasing the tendency for precipitation because it has greater solid-solubility than carbon, and further increases in strength by cold deformation. Moreover, it improves the stress corrosion cracking (SCC) resistance for these steels [4,5].

This type of stainless steel is widely used for general applications and for pressure vessels where the high temperature and moisture are present [6]. Like other austenitic stainless steels, the AISI204 tends to be sensitized in the temperature range of (450–850 °C). Sensitization phenomenon in this steel produces as an occasional event during prolonged services at high temperature, improper heat treatment, and welding process. Different factors affecting the sensitization kinetics, some of which relate to the material itself such as the chemical composition, grain size, and cold working degree. Other relate to the conditions of service that stimulate this effect. [7–9]. However, chromium-rich carbides or nitrides forms at grain boundaries during sensitization by depleting chromium from regions in the vicinity of grain boundaries of stainless steel which makes the chromium amount next to the grain boundary falls below 12% [10]. The presence of these precipitates

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