

THE INFLUENCE OF SALT BATH NITRIDING VARIABLES ON HARDNESS LAYER OF AISI 1045 STEEL

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Abstract

The aim of this paper is to study and analyze the effects of a surface controlled salt bath nitriding on the microhardness of AISI 1045 steel. The nitriding process was implemented in the salt bath component at ten different times (from 1 h to 10 h) when the temperature was constant at (520°C). The nitriding process repeated of other specimens at the same times, but the temperature was (580°C). The microstructure of the surface layers was investigated by scanning electron microscopy (SEM) and optical microscopy. Hardness profiles were measured with low-load hardness testing to determine the growth of the case depth after nitriding. Microhardness testing was carried out on samples to investigate the hardness profile at the transition from the compound to the diffusion layer. The microhardness of the surface of the nitrided sample at 520°C and 580°C was observed in the range of 318–430 HV0.3 and 329–421 HV0.3, respectively. Experimental results showed that the nitrides ϵ -Fe₂₋₃(N, C) and γ' -Fe₄(N,C) present in the compound layer increase the microhardness, It also showed that the increasing the salt bath nitriding parameters (treatment time and temperature) increases the surface hardness and hardness profile.

Keywords: salt bath, AISI 1045 steel, microhardness, time, temperature

1 Introduction

AISI 1045 steel is widely applied nowadays because of great mechanical properties and commonly used in mechanical constructions and also as a part of design. It's a material with good machinability and has proven to be capable of providing engineers a good and reliable solution when submitted to effort, corrosion, etc [1].

To improving and elevating the alloy's tribological properties, You must use thermochemical techniques such as nitriding, carburizing, and nitrocarburizing [2–3]. Nitriding treatments in several varieties of steel are widely used in industry because of their broad application range [4], Nitriding is a surface treatment technique used to introduce nitrogen into metallic materials to improve their surface hardness, mechanical properties, as well as wear [5–6] and corrosion resistance [7–8], as well as fatigue life [9, 10, 11]. The most important and oldest method of thermo chemical surface hardening operation is nitriding operation of steel which changing the chemical properties of the surface layer [12].

Salt bath nitriding is developed as an industrial process, especially for surface modification of iron-based steels; this process technology has solved environmental problems and can be applied