CONTEMPORARY METALLIC MATERIALS

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Chapter 013

The Tribological Behaviour of Al-Si Automotive Piston Material

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Keywords: Piston alloy, Wear, Microstructure, Profilometry, Surface analysis.

Abstract: Low expansion, low density and high resistance to corrosion at ambient temperature make the aluminum-silicon alloys are very suitable for wear resistant components in the automotive industry. Therefore, the main aim of this research is to conduct the wear test of the Al-Si piston alloy with the increasing sliding distance. The cylindrical shaped wear testing specimens were prepared from the piston material. Wear experiments for both lubricant and without lubricant conditions were conducted with a pin-on-disk type wear testing machine. The extent of wear rate was investigated by means of weight loss. Wear rate increased with the increase of sliding distance for both conditions. The effect of the wear on the surface profile was also investigated and it was clearly observed that before wear test the arithmetical average roughness, R_a and root mean roughness, R_q were 653 nm and 947 nm respectively and after wear test R_a and R_q were found without lubricant condition 638 nm and 898 nm and in the lubricant condition the values of R_a and R_q were observed to be 795 nm and 973 nm respectively. The wear rate was increased with the increasing sliding distance for the aluminum–silicon automotive piston alloy for both conditions.

Introduction

The dentition of tribology is the science and technology of interacting surfaces in relative motion and the word ‗Tribology' comes from the Greek word ‗Tribos', which means rubbing or attrition. It is the study of friction, wear and lubrication, which involve the movement of one solid surface over another solid surface [1]. In the industrial sector the tribological research is very important for the purpose of economical development, it can be effect directly on the cost of 1 to 4% of the gross national product (GDP), and so it is still a major problem for the whole economy [2]. In the automotive industry- wear, fatigue and premature failures are created the severe troubles which can be greatly affected on the economy of the whole automotive industry. Therefore, many attempts have been taken to produce more durable materials and techniques to reduce wear of automotive tools and components. Moreover, still it is eagerly needs to be conducted more extensive investigations in spite of many research has been carried out on the automotive piston materials. Aluminum–silicon eutectic or near eutectic alloys are cast to produce majority of pistons and are known as ‗piston alloy', which provides a good overall balance of properties [3]. In modern time automotive piston material needs to be very light weight, good strength-to-weight ratio, ease