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FATIGUE CORROSION OF 316LSS DIFFERENT CHROMIUM CONTENT

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ABSTRACT

Fatigue corrosion of 316LSS having different chromium content, the fatigue corrosion was carried out in different chromium content 10% to 16% 316L stainless steel. The test was carried out in surface impact fatigue corrosion machine. The pitting life was calculated, it gives the fatigue corrosion resistance of 316LSS and S-N curve was plotted.

Key words: Fatigue corrosion, Implants, SIFC.

INTRODUCTION

Orthopaedic Implants and Fixators for Bone fractures are used on orthopaedic patients. These implants and Fixators are made up of metals like 316LSS, Titanium, 304SS. These Implants and Fixators undergo fatigue-corrosion in the human body due repeated cycles of loading and unloading in the presence of body fluids. When corrosion is combined with fatigue the strength of the material reduces to 10% of its actual strength and also may lead to catastrophic failures of the implants and Fixators.

A Surface Impact Fatigue Corrosion (SIFC) Machine was developed to test the fatigue corrosion resistance of metals, which helps to find out in advance, this reduction in strength of the metals due to combined effect of simulated body fluids and fatigue

Weavers et al., 1987, fabricated the HIP implants using metals such as 316LSS and Titanium. These metals were loosened due to fatigue corrosion. The stability was primarily achieved with the help of screws. In the meanwhile it undergoes a fatigue corrosion.

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Need for the study

Fatigue corrosion on orthopaedic Implants and Fixators reduces the strength of the implants and Fixators, and they get loosened, which may result in non-healing of the bone. The strength of the Implant and Fixators reduces to 10% of its actual strength and also may lead to catastrophic failures of the implants and Fixators. The aim of this research is to find solution to develop fatigue corrosion resistance implant and Fixator materials.

Objectives

To develop surface impact fatigue corrosion machine and to test the fatigue corrosion resistance of the Implants and Fixator metals in simulated body fluids.

Tools and methodology

The tools used in this study are Surface Impact fatigue corrosion machine.

The methodology used in this study is, to test the fatigue corrosion resistance of materials used for orthopaedic Implants and Fixators. The SIFCM was designed, fabricated and evaluated. The apparatus consists of an acrylic box, the material to be tested is fixed on the specimen holder. A double acting cylinder is connected to the compressor, the cyclic load is applied to the sample, and a load cell is used to measure load falling on the sample. Corrosion medium is filled in the box, The number of cycles (loading and unloading) are counted by using an electronic counter.

RESULTS AND DISCUSSION

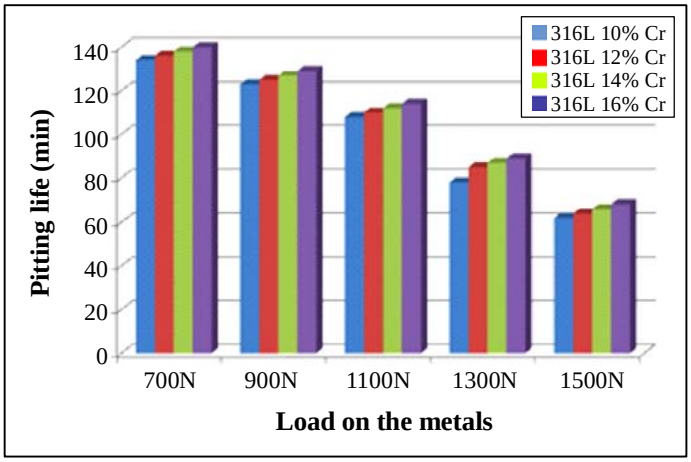
SIFC Study

The surface impact fatigue corrosion machine was designed, constructed and evaluated. Fig. 1 shows the surface impact fatigue corrosion machine construction and working.

The implant materials was tested on the SIFC machine are titanium, 316LSS, 304SS by varying the load from 700N to 1500N, Rate of loading 1.2 m/s, immersed in the corrosion mediums, sea water, salt solution, ringer solution. Fig. 2 shows the fatigue corrosion pits formed on 316LSS in ringer solution. Graph 1 shows the pitting life of the metal 316LSS with different percentage of chromium content. The results from the Graph: 1 show Surface Impact Fatigue corrosion resistance is more in 316LSS with 16% of chromium immersed in the ringer solution.

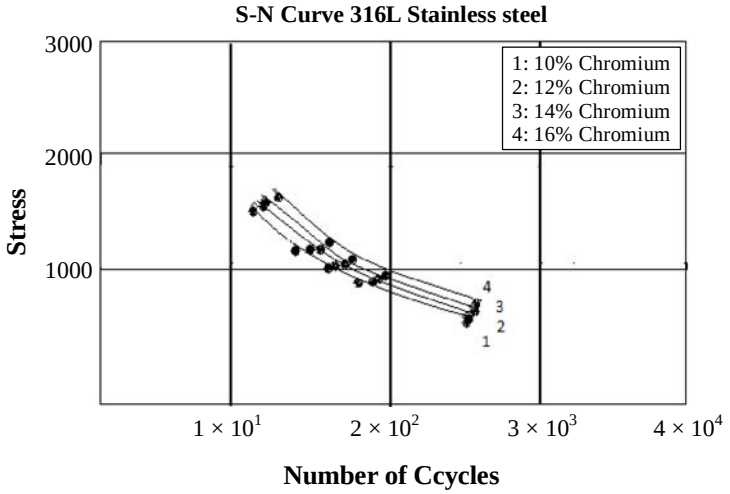
Fig. 1: Fatigue corrosion machine

Fig. 2: Fatigue corrosion sample



Graph 1: Pitting life of 316LSS immersed in ringer solution

Graph 1 shows the pitting life of the metal 316L SS with different percentage of chromium content. The results from the Graph 1 show surface impact fatigue corrosion resistance is more for 316L SS with 16% Cr content.



Graph 2: S-N Fatigue curve 316L SS

Thus by analysing all the factors of this research, brings forth the following conclusion.

The surface impact fatigue corrosion machine was developed, tested. From this study it is concluded that the fatigue corrosion resistance (Pitting) of the 316L SS for different chromium content, the resistance increases with increase in chromium content.

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