Sudan University of Science and Technology
College of Engineering
School of Mechanical Engineering – Department of Production Engineering

A Thesis submitted for the Honor Degree of BACHELOR of Mechanical Engineering

Title:

EFFECT of COATING on RESIDUAL STRESSES in ELCTROSTATIC ACTUATOR MEMS DEVICE

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Abstract:

Constitute the pressures or stresses remaining one problems resulting from manufacturing may affect these stresses negatively on the performance of manufactured parts. These residual stress may be negative or positive, which is often generated as a result of the pains Due to difference in dimensions and the material distribution in the internal structure

. one of the methods used to get rid of this stress is textured paint on the manufactured workpiece

The important results in 0.01 µpa pressure applied on the workpiece which changed the frequency from 1209.5 µhz (natural frequency) to 3011.7 µhz , with A layer (thickness = 2.2194465µm) was added to the workpiece, the residual stresses were absorbed and the frequency reduced to 1208.5 µhz.

ملخص الدارسة:

تشكل الضغوط او الاجهادات المتبقية احد الاشكالات الناتجة من عملية التصنيع وتؤثر هذه الاجهادات سلبا على اداء القطعة المصنعة . وهذه الضغوط المتبقية قد تكون سالبةأو موجبة والتي غالبا ما تتولد نتيجة لمشاكل في التصنيع نسبة اختلاف في ابعاد القطعة وتوزيع المادة في البنية الداخلية . أحد الطرق المتبعة للتحلص من هذه الاجهادات هو اضافةطبقة للقطعة المصنعة.أهم النتائج التي توصلنا اليها باضافة ضغط . 10 ميكروباسكال على القطعة المصنعةتغير التردد من قيمة 0.1021 ميكروهيرتز(التردد الطبيعي)الى قيمة 710023 ميكروهيرتزوباضافة طبقة طلاء بسمك . 2.0022.1 ميكرومتر قلت قيمة التردد الي قيمة0.1021 ميكروهيرتز.

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List of Abbreviations

MEMS Micro-Electro-Mechanical System
FEM Finite Element Method
ANSYS Analysis System
Natural frequency
Thickness
Length
Density
Elasticity modulus

1.1– Introduction:-

To understand the methodology and processes used in this Thesis it is important to have background information on the MEMS electrostatic actuator. Many different aspects will be covered in this research. Each section will cover some facet of the multidisciplinary technology of coating process . which can be considered as a part of a broad category of workpiece treatment.

1.2 - Research Problem:-

Constitute the pressures or stresses remaining one problems resulting from manufacturing may affect these stresses negatively on the performance of manufactured parts. These residual stress may be negative or positive, which is often generated as a result of the pains Due to difference in dimensions and the material distribution in the internal structure which arise when manufacturing.

1.3 - Objectives:-

This work aimed to study the effect of coating on residual stress in a micro workpiece made of silicon.