SHARP SHIFT DEVICES

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ABSTRACT

The results of design and manufacturing of the new bimagnetostriction devices which provide the objects positioning along the *X, Y, Z* coordinate axis and the turning angle round these axis are presented.

The longitudinal shift range along the *X, Y, Z* coordinate axis is 0...300 μm with the positioning precision ± 0.05 μm. The angle turning range round *X, Y, Z* coordinate axis is 90' with the positioning precision ± 1". The loading capacity is up 10 newtons.

INTRODUCTION

According to the high technologies trends development a deep interest is shown for sharp shift devices using the phenomena of magnetostriction and the reverse piezoeffect. In the first case materials change their shape and dimensions under magnetization, in the second case – under the action of the electric field. Relative dimensions changes of materials $\Delta l/l$ in both cases can reach ~ $\sim 10^{-5}...10^{-2}$ [1].

On the basis of the thermobimetallic element's effect and comparison of magnetostriction coefficients of used materials doudlelayer stripes were formed.

Such structures allow to obtain high effective compact microshift devices.

DESIGN

The main problem of the high precision positioning (sharp shift) devices design is to ensure the temperature stability, compactness and effectiveness of the magnetostrictional elements.

The bimagnetostrictional element operates on the base of the magnetostrictions coefficients difference between doublelayer stripe's materials. The metal or alloy layer with positive magnetostrictions coefficient will be called **an active** one, that with a negative one – **passive**. The stripes active layer was prepared from the (45% - Ni/ 55% - Fe)-alloy with the mag-

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netostrictions coefficient $\lambda_m = 27\times 10^{-6}$ or the (46% - Fe/54% - Pt)-alloy with $\lambda_m = 106 \times 10^{-6}$ and the passive one from Ni with $\lambda_m = -37\times 10^{-6}$ [2]. During the magnetization procedure the stripe is bent in such a way, that the layer with a positive magnetostrictions coefficient is situated on the prominent side and the layer with a negative magnetostrictions coefficient is on the concave side.

It should be mentioned that bimagnetostrictional elements can be used as measuring, compensative, control or protective device.

To raise the effectiveness and compactness of the devices we propose to use sectional bimagnetostrictional elements represented with the alternation of passive 1 and active 2 layers (fig.1).

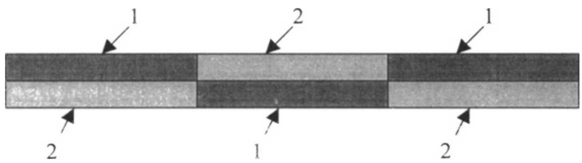

Fig.1 Sectional bimagnetostrictional element

The temperature stability of bimagnetostrictional elements is ensured by the choice of materials (45% - Ni/ 55% -Fe, 46% - Fe/54% - Pt, Ni), for which Curie-point temperature is higher than 773K [2].

PRODUCTION

The initial plaque for the bimagnetostrictional elements fabrication consists of the permalloy (45% - Ni/ 55% -Fe) or (46% - Fe/54% - Pt)-alloy 0.5 mm thickness base on which 0.2 mm Ni-layer was deposit using galvanic procedure. The layers of the plaque are tightly joined on the surface of contact and, thus, are the whole. The sectional elements were fabricated by the reverse photolithography method, i.e. on the initial plaque ((45% - Ni/ 55% -Fe) or (46% - Fe/54% - Pt)) were formed and opened on both sides by the indicated method the windows for Ni-layers deposition.

CONSTRUCTION

The stripe form bimagnetostrictional elements of certain dimentions were cut from the initial plaque. The stripes were put in the matrix-casing from Al-alloy covered with teflon to ensure longitudinal, transversal and combined shifts. According to the kind of the shifts the both or the only one end of the stripe is tightly fixed to the case.

We used combination of two or more stripes disposed in the form of a triangle, square or other geometrical figures.

CONCLUSION

According to the device's design and the way of positioning of bimagnetostrictional element one can obtain precision transversal, longitudinal, longitudinal-transversal and angle shifts. Such devices can be used in electronic and precise engineering, automatic devices, precision optical-mechanical equipment control systems, follow-up systems, were sharp linear and/or angular shifts take place.