acta phys. slov. 31. (1981), No. 2—3

DOMAIN STRUCTURE IN CYLINDRICAL AMORPHOUS CoP AND CoNiP LAYERS[1]

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In the presented paper the domain structure of electrodeposited cylindrical amorphous CoP and CoNiP layers is described. It has been shown that the internal domains of the samples are magnetized in radial directions due to the perpendicular total magnetic anisotropy. Investigating the influence of the elastic torsion stress on the domain structure their changes due to the strain anisotropy have been identified.

ДОМЕННАЯ СТРУКТУРА В ЦИЛИНДРИЧЕСКИХ АМОРФНЫХ ПЛЕНКАХ CoP i CoNiP

В работе описывается доменная структура цилиндрических аморфных пленок CoP и CoNiP, приготовленных электрохимическим осаждением. Показано, что внутренние домены намагничены в радиальных направлениях вследствие перпендикулярной полной магнитной анизотропии. При исследовании влияния на доменную структуру напряжения при кручении ниже предела упругости обнаружены изменения доменов, обусловленные анизотропией в результате деформации.

I. INTRODUCTION

In our previous work [1] we studied the magnetic properties of cylindrical (tube-like) amorphous CoP and CoNiP layers which were submitted to a torsion in the region of elastic deformation. The results were discussed in relation to the changes of the magnetic anisotropy caused by the applied strains. Is seems interesting to study the domain structure of tube-like layers also at torsion. This is the subject of the present paper.

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[1] Contribution presented at the 6th Conference on Magnetism in Košice, September 2—5, 1980.

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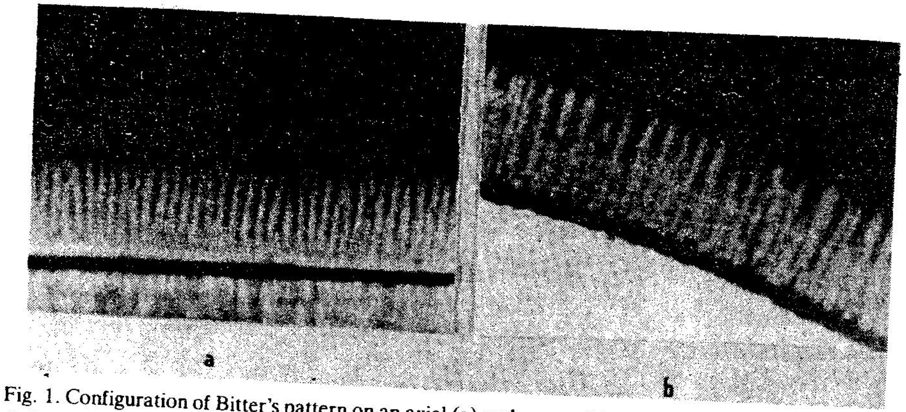

Fig. 1. Configuration of Bitter's pattern on an axial (a) and a cross (b) section of a cylindrical amorphous CoP layer.

II. RESULTS AND DISCUSSION

The domain structure observations were made on cylindrical amorphous $Co_{76}P_{24}$ and $Co_{65}Ni_{16}P_{19}$ layers with a negative magnetostriction [1]. The samples were prepared by electrodeposition [2] onto rotating cylindrical copper substrates with a diameter of 2 mm and with a length of 120 mm. The amorphousness of the samples was checked by X-ray diffraction.

Fig. 1 shows the internal magnetic domains observed by the Bitter technique in an axial (Fig. 1a) and a cros (Fig. 1b) section of the cylindrical CoP layer 60 μm thick. It is evident that owing to magnetic anisotropy the basic domains are magnetized perpendicular to the sample surface. The observed domain width is in

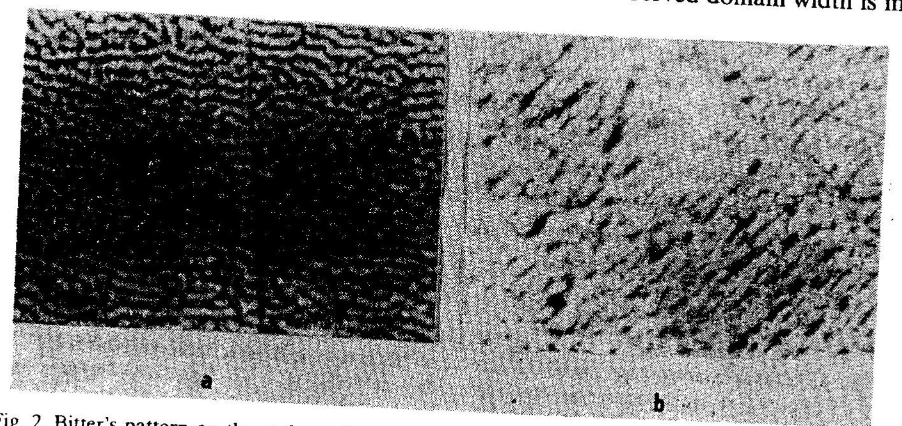

Fig. 2. Bitter's pattern on the surface of the CoP layer. (a) — in the non-stressed state, (b) — in the stressed state by twisting to an angle of 60°.

correlation with the sample thickness. Similar configurations are well known in crystalline films divided by 180° — walls and having an easy axis perpendicular to their surface.

Fig. 2 (a) shows the domain pattern on the surface of the cylindrical CoP layer 30 μm thick in the non-stressed state (twist angle $\varphi = 0°$). The secondary domain structure has the shape of the irregular (zig-zag) stripe domains.

Fig. 2 (b) shows the domain patterns on a sample twisted to an angle of 60°. The torsional elastic deformation produces marked changes in the domain pattern. The new pattern is characterized by stripes, which run approximately under an angle of 45° to the axial direction of the cylindrical layer. This shows the large influence of strain anisotropy on the easy axis direction. We observe similar domain pattern changes in the cylindrical amorphous CoNiP layers too.

III. CONCLUSION

Investigating the domain structure of the cylindrical amorphous layers the existence of radial total magnetic anisotropy of layers was identified. The changes of the domain pattern configuration of layers may be explained considering the influence of torsion on the orientation of the easy axis.

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Received October 20th, 1980