

LICENSING OPPORTUNITY

ETH transfer – Linking Science and Business

Low cost production of single crystal-like films

Keywords

Thin metal film, Biaxial texture, Single crystals, Magnetron sputter deposition, Ion bombardment, Material reliability

Summary

This smart technology provides a low-cost method of producing biaxially textured metal films which are expected to have characteristics similar to single crystals. Low energy ion irradiation of uniaxially textured films results in a selective sputtering process which leads to the formation nanocrystals having the same out-of-plane and in-plane crystallographic orientation. Biaxially textured films are obtained through epitaxial growth on the nanocrystals (Fig. 1).

Background

Reliability is a key issue in micro- and nanosystems. The most common causes of material failure (e.g. fatigue, creep, and electromigration) are strongly related to the microstructure of the materials used.

Single crystal materials are known to show higher reliability and performance compared to their polycrystalline counterparts, but they require high-cost processing techniques. It is therefore of extreme interest to develop a low-cost method able to produce single crystal materials.

Invention

The presented technology has the potential for enhancing the reliability of micro- and nano systems. Only a few low-cost processing steps in the established microfabrication technology have to be added. Originally fiber textured films can be selectively sputtered away by means of a low energy ion beam until nanocrystals with the same crystallographic orientations are left (Fig. 1). Thanks to this nanocrystal formation acting as "seeds", subsequent deposition of fresh material on top of it results in an increase of the biaxially textured film portion (Fig. 2). The repetition of these two steps allows for the growth of continuous biaxially textured films.

Patent Status

- Patent pending EP

Features & Benefits

- Time and cost effective production of biaxially textured thin films
- Expected increase in film mechanical and electrical properties
- Potentially fast integration of the technology in microelectronic industry

Field of Application

- Microelectronic industry

References

- Ke Zeng, et.al. "Converting polycrystals into single crystals by low energy ion bombardment", Master Thesis, ETH Zurich, Sep. '09

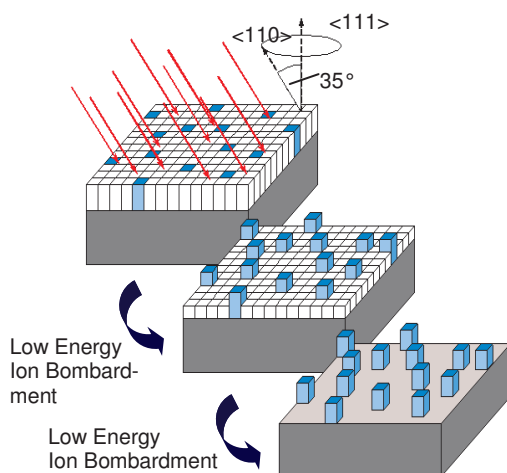


Fig. 1: Selective sputtering process creating "seeds" of single crystals

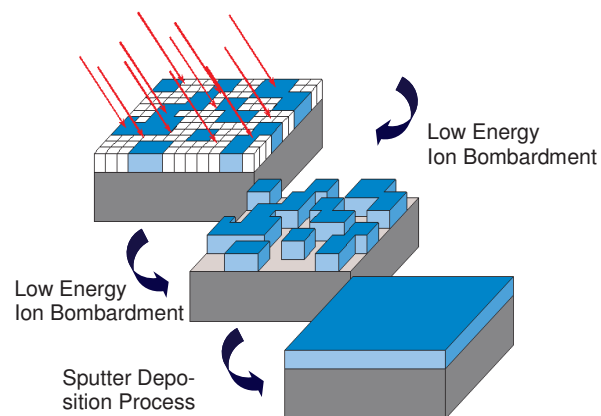


Fig. 2: Biaxially textured film formation upon material deposition on the "seed" single crystals

Ref. No. T 10-020

ETH Zurich
ETH transfer
Zurich, Switzerland

+41 44 632 23 82
transfer@sl.ethz.ch
www.transfer.ethz.ch

ETH

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich