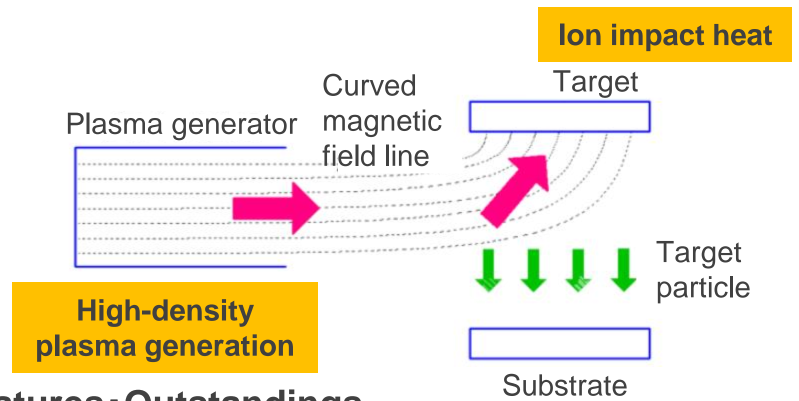
Tohoku Univ. Technology

High-density plasma sputtering device

Damage-less sputtering / Independent control of ion energy and flux / Useable in ferromagnetic target

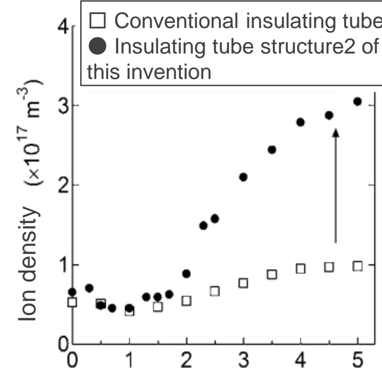


Overview

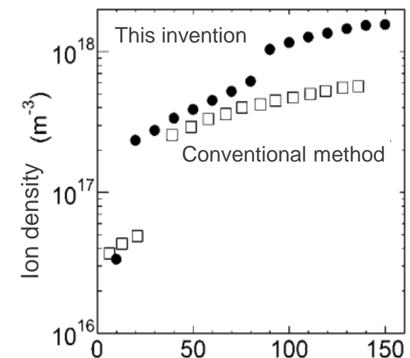
With the increase of request for device miniaturization and thin crystal film quality improvement, the ion damage on substrate has become a major issue in sputtering. The magnetron sputtering method is widely used but since the plasma is formed directly between the target material and the substrate, “① it is difficult to avoid ion damage”. This issue is amplified when generating high-density plasma. In addition, since a single power supply is responsible for both the plasma generation and ion attraction, “② it is impossible to independently control the ion flux and energy flowing into the target material”. Moreover, since the plasma is confined by the magnetic leakage flux on the target surface, “③ it is difficult to use for ferromagnetic material target”.

This invention solves above ①/②/③ issues by generating high-density plasma with helicon discharge and by controlling the plasma shape with a curved magnetic field, etc. This invention could also be considered to be used as a heating mechanism of the target material, or as an uniform & fast film deposition.

Features･Outstandings



Plasma density increases with the “insulating tube structure” of this invention (●) compared to conventional method (□)



Plasma density increases with the "curved magnetic field line" of this invention (●) compared to conventional method (□)

Product Application

- High quality crystalline thin film formation without damage to substrate
- Film deposition from a thick ferromagnetic target material
- Film deposition of target material by repeated evaporation & sublimation
- Uniform film formation on large diameter target and substrate

Related Works

[1] T. Saito, K. Takahashi, et al., Vacuum, 163, 269 (2019).
[2] K. Takahashi et al., Vacuum, 171, 109000 (2020).
[3] TAKAHASHI Kazunori, Plasma Technologies in an Innovative Semiconductor Industrial System: Minimal Fab－ Multi-Target Sputtering Tool Using a Helicon Plasma Source, J.Plasma Fusion Res. 10, 522 (2020).

IP Data

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