

**United States Patent** [19]

Hiraki et al.

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[54] **COATING FILM AND METHOD AND APPARATUS FOR PRODUCING THE SAME**

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[58] **Field of Search** ..... 204/192 C, 192 E, 192 SP, 204/192 R, 298; 428/408

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[57] **ABSTRACT**

A coating film comprises an amorphous carbon of a specified atomic ratio with respect to hydrogen and carbon and it is excellent in hardness, oxidation resistance, thermal resistance, electric resistance and thermal conductivity. The coating film is produced by sputtering a graphite target electrode in an atmosphere of hydrogen, fluorine or a mixture of hydrogen and fluorides having a gas pressure of 6.665 to 666.5 Pa (0.05 to 5.0 Torr) while maintaining the relative current density for the graphite target electrode and a power source between 11.3 and 14.7 ma/cm<sup>2</sup> thereby limiting the H/C ratio in terms of an atomic ratio between 0.5 and 0.9. A sputtering apparatus used for producing such coating film includes a coating forming deposition substrate arranged at a position within a sputtering vacuum container which is not directly exposed to a plasma or a deposition substrate mounted on an electron drawing electrode within the container and a plasma adjusting electrode positioned in front of the substrate.

**13 Claims, 6 Drawing Figures**

