

Accepted Manuscript

Silicon Carbonitride Thin Films Deposited by Reactive High Power Impulse Magnetron Sputtering

Tuomas Hänninen, Susann Schmidt, Ivan G. Ivanov, Jens Jensen, Lars Hultman, Hans Högberg

PII: S0257-8972(17)31260-4
DOI: doi:[10.1016/j.surfcoat.2017.12.037](https://doi.org/10.1016/j.surfcoat.2017.12.037)
Reference: SCT 22955

To appear in: *Surface & Coatings Technology*

Received date: 25 September 2017
Revised date: 13 December 2017
Accepted date: 15 December 2017



Please cite this article as: Tuomas Hänninen, Susann Schmidt, Ivan G. Ivanov, Jens Jensen, Lars Hultman, Hans Högberg, Silicon Carbonitride Thin Films Deposited by Reactive High Power Impulse Magnetron Sputtering, *Surface & Coatings Technology* (2017), doi:[10.1016/j.surfcoat.2017.12.037](https://doi.org/10.1016/j.surfcoat.2017.12.037)

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Silicon Carbonitride Thin Films Deposited by Reactive High Power Impulse Magnetron Sputtering

Tuomas Hänninen^{a,*}, Susann Schmidt^b, Ivan G. Ivanov^c, Jens Jensen^a, Lars Hultman^a, Hans Högberg^a

^a*Thin Film Physics Division, Department of Physics, Chemistry and Biology (IFM), Linköping University, SE-581 83, Sweden*

^b*IHI Ionbond AG, Industriestraße 211, CH-4600 Olten, Switzerland*

^c*Semiconductor Materials Division, Department of Physics, Chemistry and Biology (IFM), Linköping University, SE-581 83, Sweden*

Abstract

Amorphous silicon carbonitride thin films for biomedical applications were deposited in an industrial coating unit from a silicon target in different argon/nitrogen/acetylene mixtures by reactive high power impulse magnetron sputtering (rHiPIMS). The effects of acetylene (C_2H_2) flow rate, substrate temperature, substrate bias voltage, and HiPIMS pulse frequency on the film properties were investigated. Low C_2H_2 flow rates (< 10 sccm) resulted in silicon nitride-like film properties, seen from a dense morphology when viewed in cross-sectional scanning electron microscopy, a hardness up to ~ 22 GPa as measured by nanoindentation, and Si–N bonds dominating over Si–C bonds in X-ray photoelectron spectroscopy core-level spectra. Higher C_2H_2 flows resulted in increasingly amorphous carbon-like film properties, with a granular appearance of the film morphology, mass densities below 2 g/cm³ as measured by X-ray reflectivity, and a hardness down to 4.5 GPa. Increasing substrate temperatures and bias voltages resulted in slightly higher film hardnesses and higher compressive residual stresses. The film H/E ratio showed a maximum at film carbon contents ranging between 15 – 30 at.% and at elevated substrate temperatures from 340 °C to 520 °C.

*Corresponding author
Email address: tuoha@ifm.liu.se (Tuomas Hänninen)

Download English Version:

<https://daneshyari.com/en/article/8024444>

Download Persian Version:

<https://daneshyari.com/article/8024444>

[Daneshyari.com](https://daneshyari.com)