

Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Optical Properties of Magnetron sputtered Nickel Thin Films

FIDELE TWAGIRAYEZU, WILHELMUS J. GEERTS, YUBO CUI, Texas State Univ-San Marcos — The study of optical properties of Nickel (Ni) is important, given the pivotal role it plays in the semiconductor and nano-electronics technology. Ni films were made by DC and RF magnetron sputtering in an ATC Orion sputtering system of AJA on various substrates. The optical properties were studied ex situ by variable angle spectroscopic (220-1000 nm) ellipsometry at room temperature. The data were modeled and analyzed using the Woollam CompleteEase Software fitting ellipsometric and transmission data. Films sputtered at low pressure have optical properties similar to that of Palik [1]. Films sputtered at higher pressure however have a lower refraction index and extinction coefficient. It is expected from our results that the density of the sputtered films can be determined from the ellipsometric quantities. Our experiments also revealed that Ni is susceptible to a slow oxidation changing its optical properties over the course of several weeks. The optical properties of the native oxide differ from those of reactive sputtered NiO similar as found by [2]. Furthermore the oxidation process of our samples is characterized by at least two different time constants.

[1] Edward D.Palik, Handbook of Optical Constants of Solids, Academic Press (1998), p 313-323.

[2] Lina S. Abdallah, thesis New Mexico State University, August 2014.

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Date submitted: 16 Nov 2014

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