

Accepted Manuscript

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PII: S0169-4332(18)32259-1

DOI: <https://doi.org/10.1016/j.apsusc.2018.08.124>

Reference: APSUSC 40161

To appear in: *Applied Surface Science*

Received Date: 31 May 2018

Accepted Date: 16 August 2018

Please cite this article as: J. Sancho-Parramon, B. Okorn, K. Salamon, V. Janicki, Plasmonic resonances in copper island films, *Applied Surface Science* (2018), doi: <https://doi.org/10.1016/j.apsusc.2018.08.124>

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Plasmonic resonances in copper island films

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Abstract

The optical properties of Cu island films, in particular their plasmonic behaviour, are investigated. The films are fabricated by electron beam evaporation using different deposition parameters (deposited mass thickness and substrate temperature). The optical response can be tuned from a metal-like behaviour to well-defined localized surface plasmon resonances and is well correlated with the structural and morphological properties of the samples. Significant changes of optical properties take place with sample aging, including quenching and non-monotonic frequency shift of the plasmon resonance. These changes are interpreted in terms of Cu oxidation process, that appears to strongly depend on the initial morphology of samples. Theoretical calculations in the framework of effective medium theories qualitatively explain the experimental observations. Overall, the results give a detailed insight on the morphology dependence and time evolution of the optical response of Cu island films that may provide useful guidelines for applying these nanostructures in plasmonic applications.

Keywords: copper, metal island films, localized surface plasmon resonance, optical characterization, ellipsometry, copper oxide, effective medium theory

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