

Accepted Manuscript

Nonlinear conductivity in silicon nitride

Enis Tuncer

PII: S0038-1101(17)30126-0

DOI: <http://dx.doi.org/10.1016/j.sse.2017.05.010>

Reference: SSE 7235

To appear in: *Solid-State Electronics*

Received Date: 15 February 2017

Accepted Date: 24 May 2017



Please cite this article as: Tuncer, E., Nonlinear conductivity in silicon nitride, *Solid-State Electronics* (2017), doi: <http://dx.doi.org/10.1016/j.sse.2017.05.010>

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.

Nonlinear conductivity in silicon nitride

Enis Tuncer

Texas Instruments Incorporated, Dallas 75243 Texas USA

Abstract

To better comprehend electrical silicon-package interaction in high voltage applications requires full characterization of the electrical properties of dielectric materials employed in wafer and package level design. Not only the packaging but wafer level dielectrics, *i.e.* passivation layers, would experience high electric fields generated by the voltage applied pads. In addition the interface between the passivation layer and a mold compound might develop space charge because of the mismatch in electrical properties of the materials. In this contribution electrical properties of a thin silicon nitride (Si_3N_4) dielectric is reported as a function of temperature and electric field. The measured values later analyzed using different temperature dependent exponential expressions and found that the Mott variable range hopping conduction model was successful to express the data. A full temperature/electric field dependency of conductivity is generated. It was found that the conduction in Si_3N_4 could be expressed like a field ionization or Fowler-Nordheim mechanism.

Keywords: Silicon nitride, nonlinear conductivity

1. Introduction

When high voltage applications are considered electrical properties of dielectrics become important because of electric field sharing between different dielectric materials, and its influence in dielectric losses associated to polarization and charge transport.

- 5 In addition electrical silicon-package-interaction imposes some restriction on the device design (tolerances) and selection of materials; the mold compounds and field grading

Email address: e-tuncer@ti.com, enis.tuncer@physics.org (Enis Tuncer)

URL: www.ti.com (Enis Tuncer)

Preprint submitted to Solid State Electronics

May 8, 2017

Download English Version:

<https://daneshyari.com/en/article/5010176>

Download Persian Version:

<https://daneshyari.com/article/5010176>

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