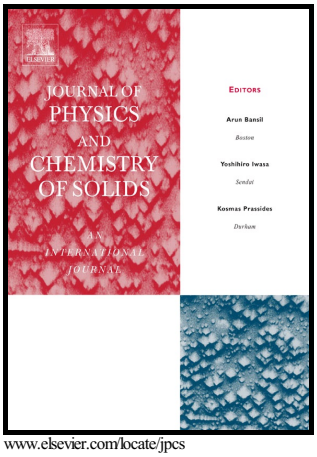
# Nucleophilic stabilization of water-based reactive ink for titania-based thin film inkjet printing

C. Gadea, D. Marani, V. Esposito




www.elsevier.com/locate/jpcs

PII: S0022-3697(16)30365-1
DOI: http://dx.doi.org/10.1016/j.jpcs.2016.10.004
Reference: PCS7875

To appear in: *Journal of Physical and Chemistry of Solids*

Received date: 23 July 2016
Revised date: 19 September 2016
Accepted date: 17 October 2016

Cite this article as: C. Gadea, D. Marani and V. Esposito, Nucleophilic stabilization of water-based reactive ink for titania-based thin film inkjet printing *Journal of Physical and Chemistry of Solids* http://dx.doi.org/10.1016/j.jpcs.2016.10.004

# Nucleophilic stabilization of water-based reactive ink for titania-based thin film inkjet printing

C. Gadea*, D. Marani, V. Esposito

DTU Energy, Technical University of Denmark, Risø Campus, Frederiksborgvej 399, DK - 4000

Roskilde, Denmark

*Corresponding author. chga@dtu.dk

Abstract

Drop on demand deposition (DoD) of titanium oxide thin films (< 500 nm) is performed via a novel titanium-alkoxide-based solution that is tailored as a reactive ink for inkjet printing. The ink is developed as water-based solution by a combined use of titanium isopropoxide and n-methyldiethanolamine (MDEA) used as nucleophilic ligand. The function of the ligand is to control the fast hydrolysis/condensation reactions in water for the metal alkoxide before deposition, leading to formation of the $TiO_2$ only after the jet process. The evolution of the titanium-ligand interactions at increasing amount of MDEA is here elucidated in terms of long term stability. The ink printability parameter (Z) is optimized, resulting in a reactive solution with printability, Z, > 1, and chemical stability up to 600 hours. Thin titanium oxide films (<500 nm) are proved on different substrates. Pure anatase phase is obtained after annealing at low temperature (ca. 400 °C).

Keywords: Inkjet, thin film, sol-gel, rheology, Titania.



## 1. Introduction

Inkjet printing of inorganic materials has been spreading over the past years in several key technologies such as energy devices, sensors, electronics, biomedical applications and flexible