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

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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

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