

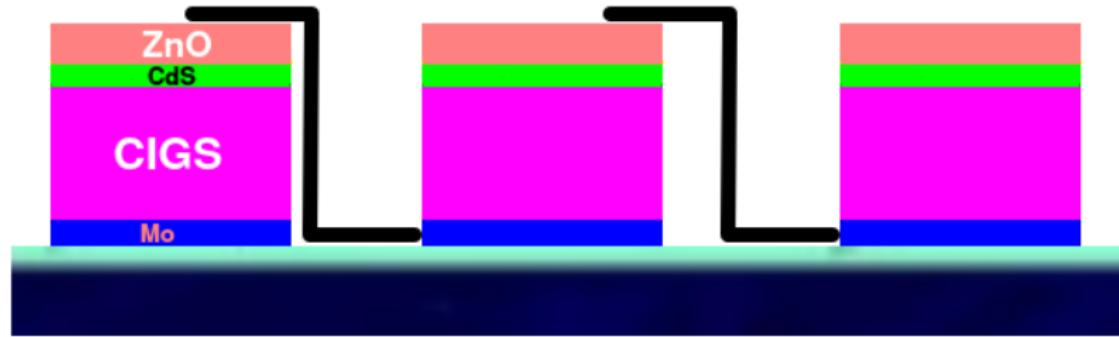
Status report: Insulating zirconia oxide layers on steel

Johann Dorn

December 1, 2020

Introduction

- Project: **InnovaSteel4CIGS** (AIT - Sunplugged)
- **CopperIndiumGalliumSelenide**
- Objective:
 - Insulating coating for stainless steel
 - ZrO_2 and/or Al_2O_3
 - Scalability for industry
- application: insulation between CIGS cell and steel foil



Starting point

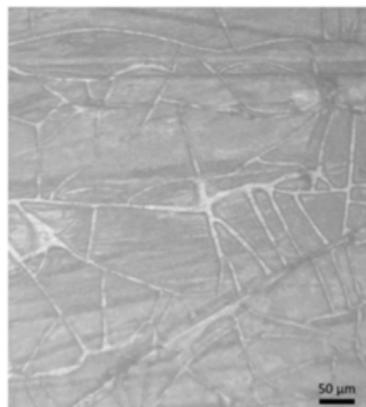
4th International Conference on Mechanical Engineering Research (ICMER2017)

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Morphology evaluation of ZrO₂ dip coating on mild steel and its corrosion performance in NaOH solution

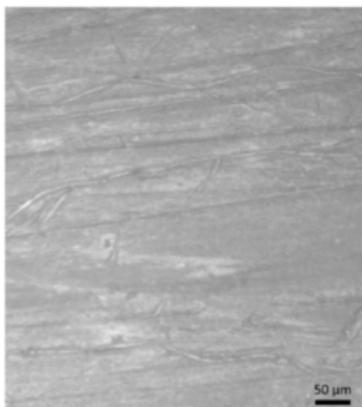
M A Anwar¹, T Kurniawan¹, Y P Asmara¹, W S W Harun², A N Oumar³, A B D Nandyanto⁴



(a) 3 dipping



(b) 5 dipping

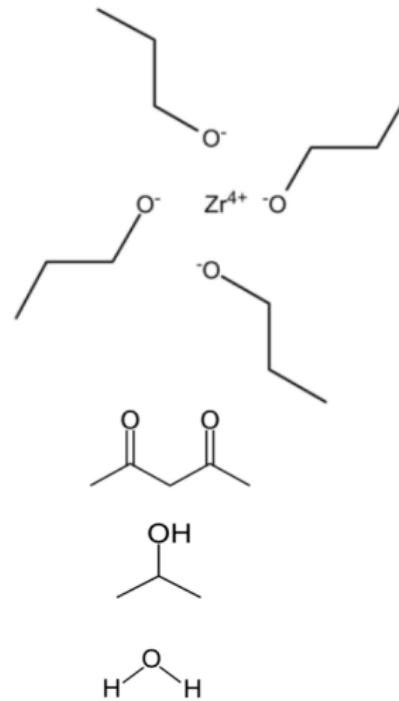


(c) 7 dipping

Recipe and Parameters

Recipe 1:

- 8ml Zr(OPr)₄
- 8ml AcAc
- 2ml i-PrOH
- 2.6ml H₂O



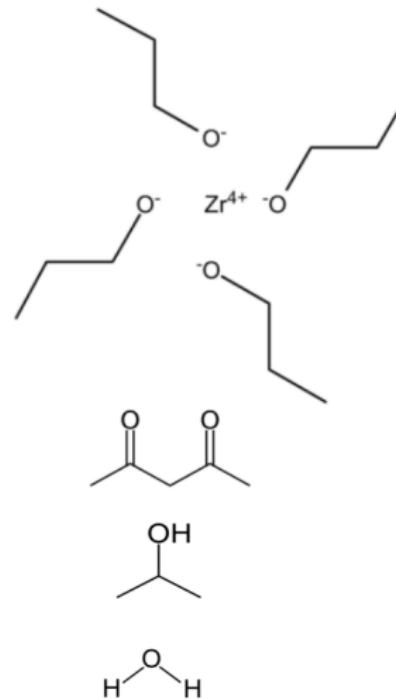
Recipe and Parameters

Recipe 1:

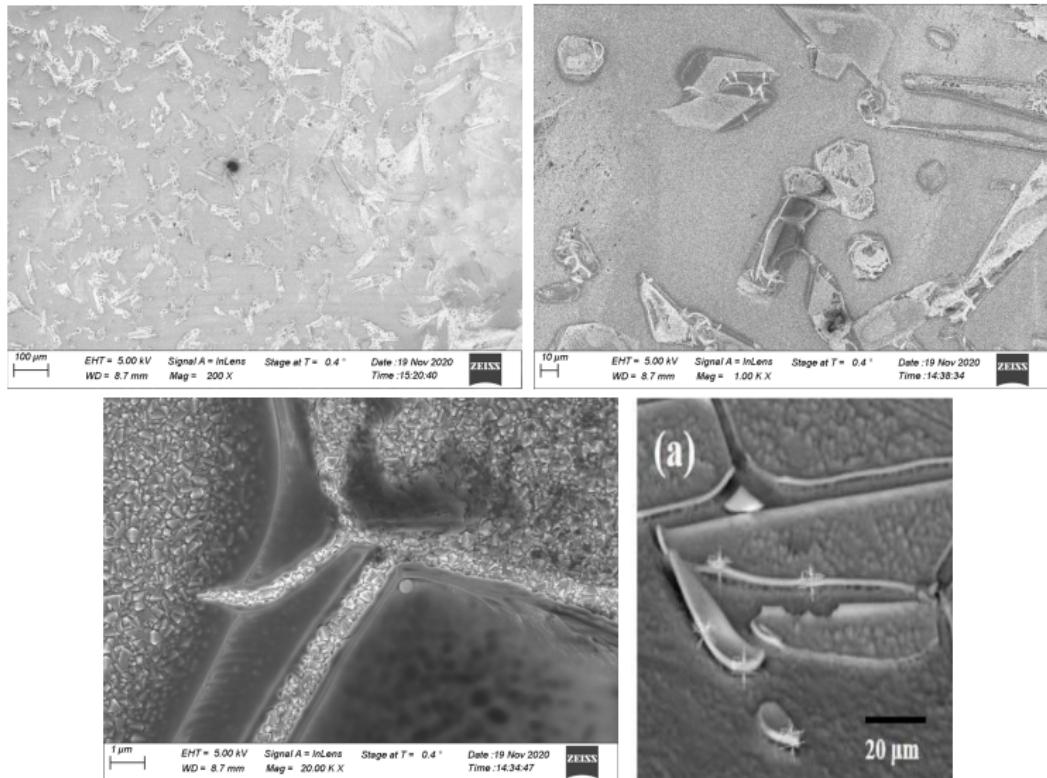
- 8ml Zr(OPr)₄
- 8ml AcAc
- 2ml i-PrOH
- 2.6ml H₂O

Parameters:

- Heating rate
- calcination temperature
- Mixing time
- pH regulator
- Surfactant
- High molecular polymer



SEM results



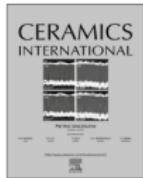
Adapted recipe 2

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Contents lists available at ScienceDirect

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journal homepage: www.elsevier.com/locate/ceramint

A new sol-gel route to prepare dense Al_2O_3 thin films



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Recipe 2:

- 9.9ml 1-BuOH
- 0.1ml $\text{Zr}(\text{OPr})_4$
- 0.025 AcAc
- 2ml AcOH

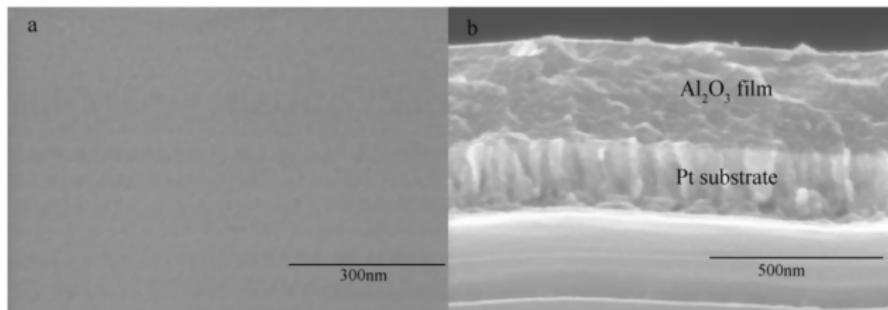
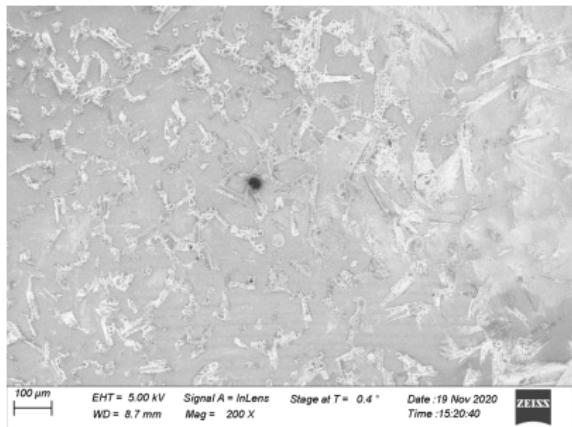
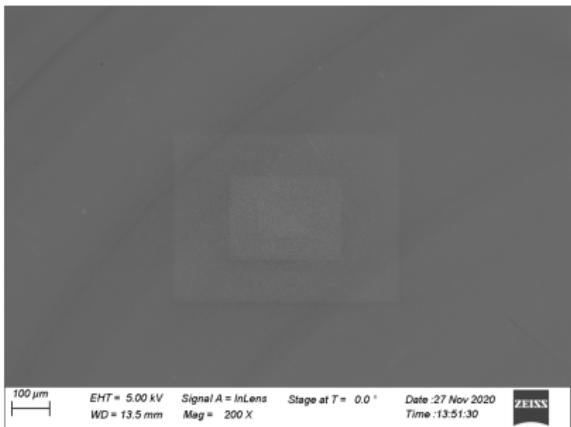


Fig. 6. FE-SEM micrograph of surface (a) and cross section (b) of an Al_2O_3 film.

SEM results

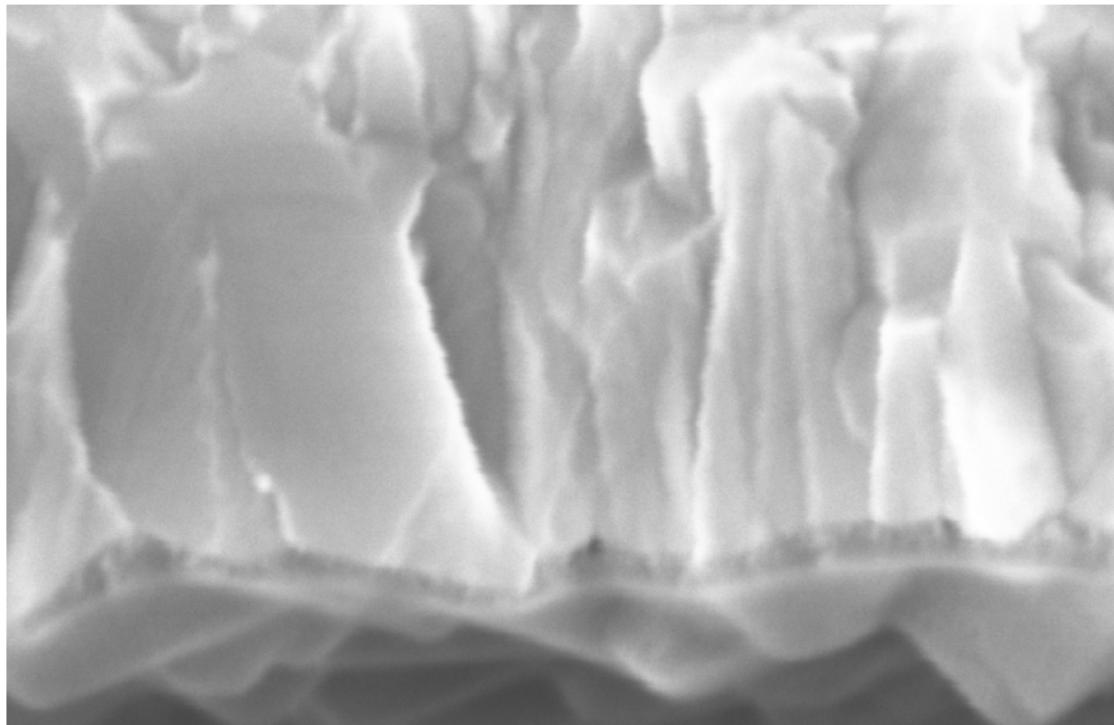


(a) Recipe 1



(b) Recipe 2

SEM cross section



100 nm



EHT = 5.00 kV

WD = 10.6 mm

Signal A = InLens

Mag = 366.80 KX

Stage at T = 0.0 °

Date :30 Nov 2020

Time :14:11:02



Summary and Outlook

- 100nm layer
- dielectric properties: I-V, C-V
- optical spectrometry
- XRD
- Machine Learning