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NATURAL AND  
AGRICULTURAL SCIENCES  
NATUUR- EN  
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Contribution ID: 57

Type: **Poster Presentations**

## Surface morphology and structural properties of iron oxide thin film photoanode prepared by dip coating: effect of electrochemical oxidation

Wednesday, 6 May 2015 13:30 (1h 30m)

Metal oxides have attracted a considerable attention as transparent electrodes, active layers and charge collectors in energy harvesting activities due to their diverse properties [1]. Due to its a nearly ideal band gap ( $\sim 2.1$  eV) for solar energy conversions, low cost, chemical stability, natural abundance, n-type conductivity, “rust”- iron oxide ( $\alpha$ -Fe<sub>2</sub>O<sub>3</sub>) - is regarded as a promising semiconductor in photovoltaic (PV) solar cells and photoelectrochemical (PEC) cells [2]. However, despite the good characteristics  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> absorbs weakly and conducts poorly due to poor carrier transport and rapid recombination of photo-generated electrons and holes. Surface morphology and structural properties strongly influences photoactivity efficiency of nanostructured electrodes [3].  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> thin films were prepared by dip-coating method on fluorinated tin oxide (FTO) conductive glass substrates from Fe (NO<sub>3</sub>)<sub>3</sub>·9H<sub>2</sub>O (28.0 g) and oleic acid (17.0 g) precursor. Four layers of hematite films were obtained after repeated dip coating and annealing at 500 ° C for 2 hours. The photoanodes were electrochemically oxidized (anodized) in 1M KOH at a constant anodization potential of 500 mV for 1 min in dark and light conditions. The structural properties of  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> nanoparticles were investigated.

### 2. Results

Fig 1 shows top view images of high resolution FE-SEM of pristine and anodized  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> thin film photoanodes. The nanoparticles were spherical in shape. The micrographs depicts a denser surface after electrochemical oxidation of photoanodes in light. Fig 2 XRD diffractograms of the films. The results show decrease in linewidth of the peaks in anodized samples which indicates increase in crystallite sizes upon the treatment.

### Are you currently a postgraduate student? (Yes/No)

YES

### At what level of studies are you currently? (Hons/MSc/PhD)

PhD

### Please provide the name and email address of your supervisor.

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**Session Classification:** Poster

**Track Classification:** SACPM