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Activities of the Core

Aug. 23, 2019 The 36th HU-ACE Steering Committee Meeting

Kids Energy Symposium 2019

Kids Energy Symposium 2019 was co-organized on July 27, 2019 at Hiroshima University. Due to the overlapping events the participants were fewer than usual, but the weather was very good and there were totally 27 elementary school students and their parents joining it. As every year, there was a presentation about automobile by Mazda Co., and after the following quiz competition, students conducted three types of science experiments. Participation award was handed to all the students and five prizes were given to the students who had excellent results on the quiz competition. We also distributed a crossword puzzle.

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Research Topics

Photochromic phenomena at the interface of metal oxides

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Research field: micro nano thermal engineering, surface science
Keyword: nano particles, thermal, photochromism

Abstract

Background

It was reported that metal oxide film showed photochromism and it could work as a cell storage. However, no one can show its mechanism and it was difficult to reproduce this phenomenon. In addition, the mechanism of photochromism for this case was also unclear, so that we focused on this matter, firstly.

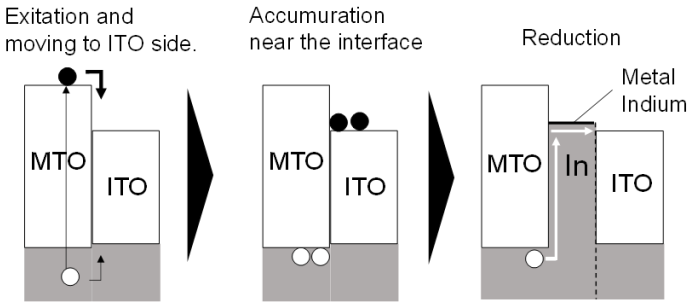
Methods

As for the synthesis method, we prepare the glass substrate with ITO layer of 200-300 nm. Then, we coat the substrate by magnesium and tin solution. Then, the substrate was baked under the air in order to remove unnecessary organics. Finally, UV irradiation was conducted by the mercury lamp. If this synthesis goes well, we can obtain black-colored sample. This color can be erased by thermal treatment, reversibly. For the first time, we could not succeed in this synthesis and its reproducibility was less than 1 %; however, at present the reproducibility is more than 90 %.

We proposed why the color changes from transparent to black according to the experiment. Then, based on this mechanism, we synthesized sample of different combination of elements in order to confirm the model. Partially, we employed quantum chemical calculation, but I feel we have to focus on this matter. Therefore, we consider collaboration with the specialist of theoretical researcher.

Results

In short, the mechanism is very easy. When we irradiate UV from the surface of MTO layer, electron in the MTO is excited into its conduction band. Then, near the interface, this electron goes to the ITO and it is captured by indium orbit. Consequently, indium is reduced to be metallic indium. This is the cause of coloration.



The formation of metallic indium was confirmed by XRD experiment, and we succeeded to obtain photochromic samples made from different combination of elements that follow the appropriate electronic structure shown in the figure.

References

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