LIST OF AUTHOR'S PUBLICATIONS AND CONFERENCES

1. List of publications

1. **S. Sutthana**, D. Wongratanaphisan, A. Gardchareon, S. Phadungdhitidhada, P. Ruankham, S. Choopun, "Enhancement of ZnO Dye-Sensitized Solar Cell Performance by Modifying Photoelectrode Using Two-Steps Coating-Etching Process", Energy Procedia, 79 (2015) 1021-1026.
2. **S. Sutthana**, D. Wongratanaphisan, A. Gardchareon, S. Phadungdhitidhada, P. Ruankham, S. Choopun, "Enhancement of ZnO dye-sensitized solar cell performance by modifying photoelectrodes using an acid vapor texturing process", Surface and Coatings Technology, *In Press*.
3. **S. Sutthana**, D. Wongratanaphisan, A. Gardchareon, S. Phadungdhitidhada, P. Ruankham, S. Choopun, "Surface Modification of Porous Photoelectrode using Etching Process for Efficiency Enhancement of ZnO Dye-sensitized Solar Cells", Journal of Nanomaterials, *In Press*.

2. List of conferences

1. **S. Sutthana**, D. Wongratanaphisan, A. Gardchareon, S. Phadungdhitidhada, S. Choopun, "Enhancement of ZnO dye-sensitized solar cells by combining two techniques of etching process with NH_4OH aqueous solutions and dye re-adsorption technique", the 3rd Southeast Asia Conference on Thermoelectrics (SACT2014), 22-23 November 2014, Pakse, Lao PDR (Oral presentation).
2. **S. Sutthana**, K. Hongsith, C. Bhoomanee, D. Wongratanaphisan, A. Gardchareon, S. Phadungdhitidhada, S. Choopun, "Enhancement of ZnO Dye-sensitized Solar Cell Performance by Chemical Wet Etching Process", the 2nd International Materials, Industrial, and Manufacturing Engineering Conference (MIMEC2015), 4-6 Febuary 2015, Bali, Indonesia (Oral presentation).

3. **S. Sutthana**, D. Wongratanaphisan, A. Gardchareon, S. Phadungdhitidhada, P. Ruankham, S. Choopun, "Enhancement of ZnO dye-sensitized solar cell performance by modifying photoelectrode using two-steps coating-etching process", the 2015 International Conference on Alternative Energy in Developing Countries and Emerging Economies (2015 AEDCEE), 28-29 May 2015, Bangkok, Thailand (Poster presentation).

4. **S. Sutthana**, D. Wongratanaphisan, A. Gardchareon, S. Phadungdhitidhada, P. Ruankham, S. Choopun, "Enhancement of ZnO Dye-sensitized Solar Cell Performance by Modifying Photoelectrode using Acid Vapor Texturing Process", the 19th International Conference on Surface Modification of Materials by Ion Beams (SMMIB-19), 22-27 November 2015, Chiang Mai, Thailand (Oral presentation).

3. Awards

S. Sutthana, D. Wongratanaphisan, A. Gardchareon, S. Phadungdhitidhada, S. Choopun, "Enhancement of ZnO dye-sensitized solar cells by combining two techniques of etching process with NH_4OH aqueous solutions and dye re-adsorption technique", the 3rd Southeast Asia Conference on Thermoelectrics (SACT2014), 22-23 November 2014, Pakse, Lao PDR, 3rd oral presentation award.

APPENDIX A

Image Processing Analysis

1. The pore density

The pore density is analyzed from the ordinary FE-SEM image using a free image software according to the following details.

(i) Convert step, an ordinary FE-SEM image was converted to form a binary gray scale image with 8-bits (image >> type >> 8-bit).

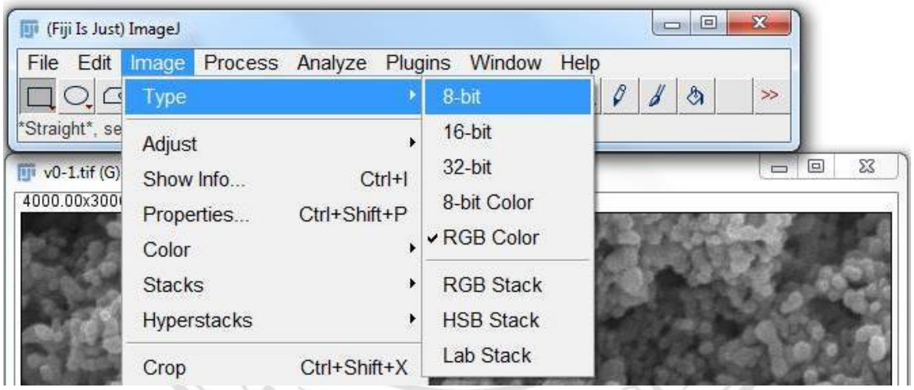

Figure A.1 A convert of ordinary FE-SEM image using image-J software.

(ii) Threshold adjustment, the binary image was adjusted by threshold the image to verify pore and aggregate zone (image >> adjust >> threshold >> auto).

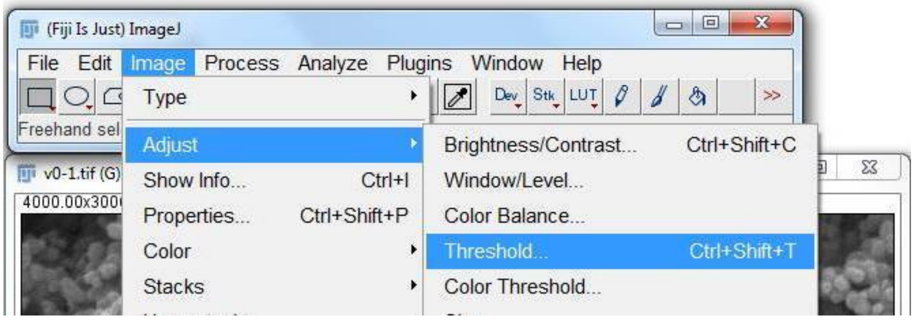

Figure A.2 A threshold process.

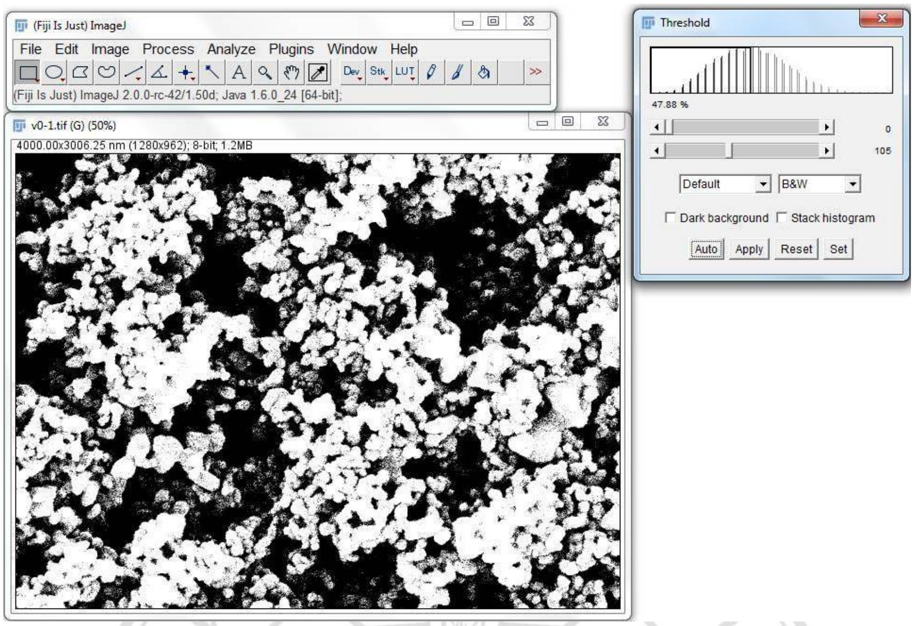

Figure A.3 Threshold adjustment with auto scale.

(iii) Pore analysis, the verified pore was counted (analyze >> analyze particles). Count parameters detail; Size (nm^2) is 0-infinity to count all of the pore size, Circularity is 0.00-1.00 to count all of the pore shape.

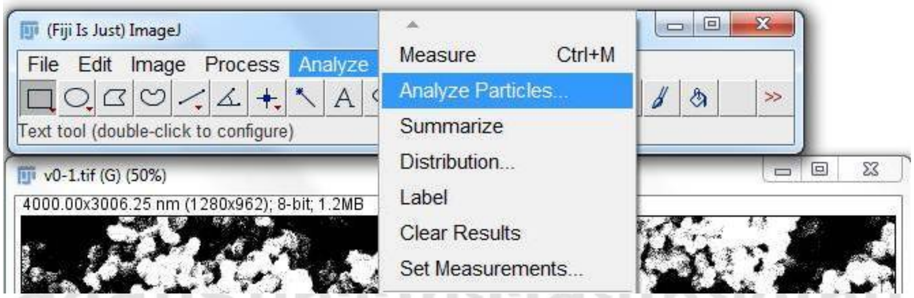

Figure A.4 The analyze particle of pore.

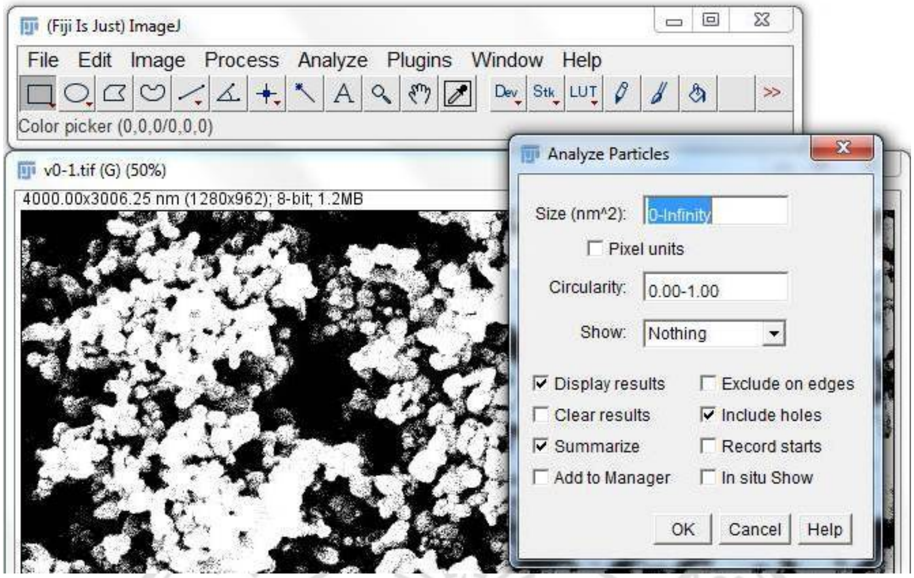

Figure A.5 The analyze particle of pore with counting parameters.

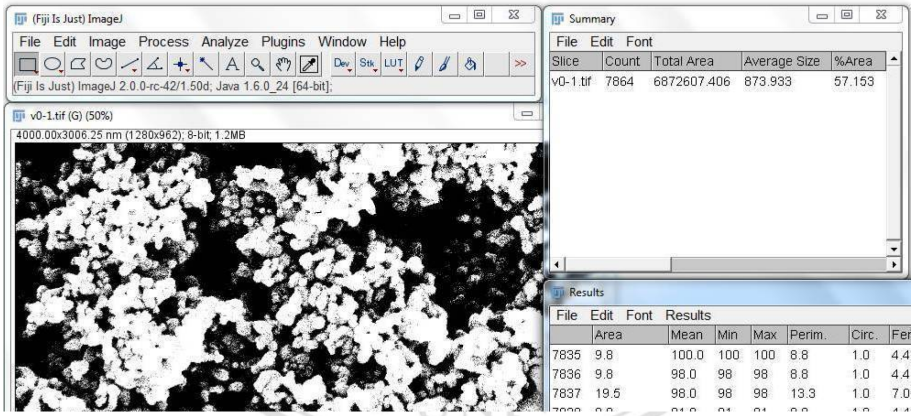

Figure A.6 Counted pore include Summary and Results.

After the pore analysis, the number of pores, “Count”, and image area (in μm^2) are used to calculate pore density according to the equation (A.1) [79].

$$\text{Pore density} = \frac{\text{number of pores}}{\text{area } (\mu\text{m}^2)} \quad \text{(A.1)}$$

2. The pore size distribution

After the pore analysis, pore size was calculated from the “Area” result using equation (A.2) under the circular pore shape assumption, and pore frequency in each range is counted.

$$\text{Pore size} = 2\sqrt{\frac{\text{Area}}{\pi}} \tag{A.2}$$

3. The simulated 3D profile and roughness analysis

After select a figure, the simulated 3D profile was analyzed by using analyze tool (Analyze >> 3D Surface Plot) as can be seen in figure A.7. The 3D profile is performed in figure A.8.

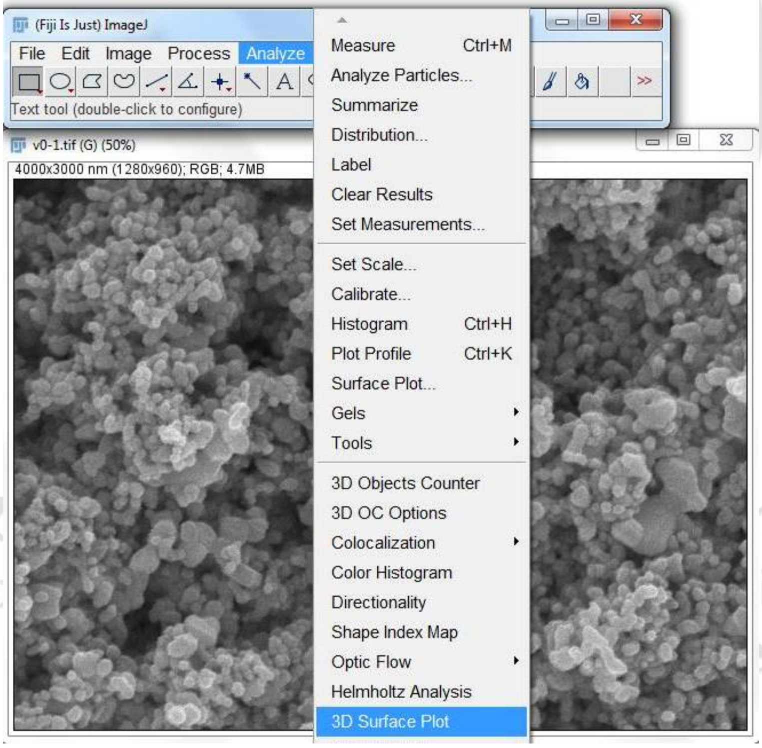

Figure A.7 The analyze 3D profile.

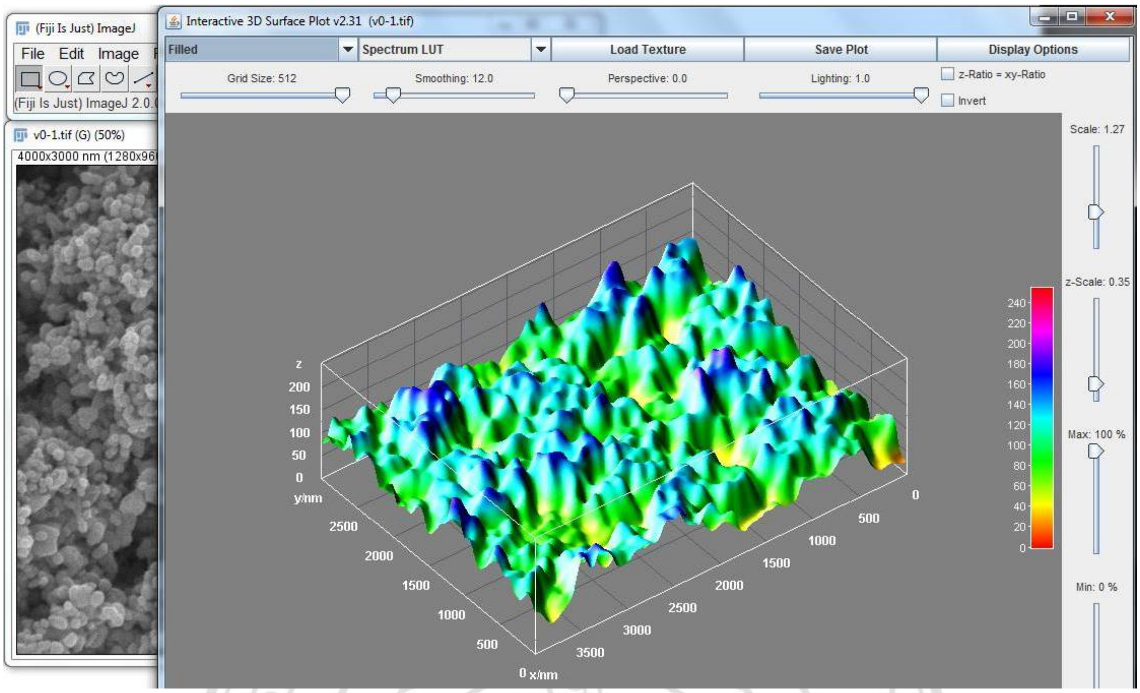

Figure A.8 The simulated 3D profile.

The roughness was calculated by using plugins tool (Plugins >> Roughness calculation) as can be seen in figure A.9. After the calculation, the relative roughness data is obtained as shown in figure A.10.

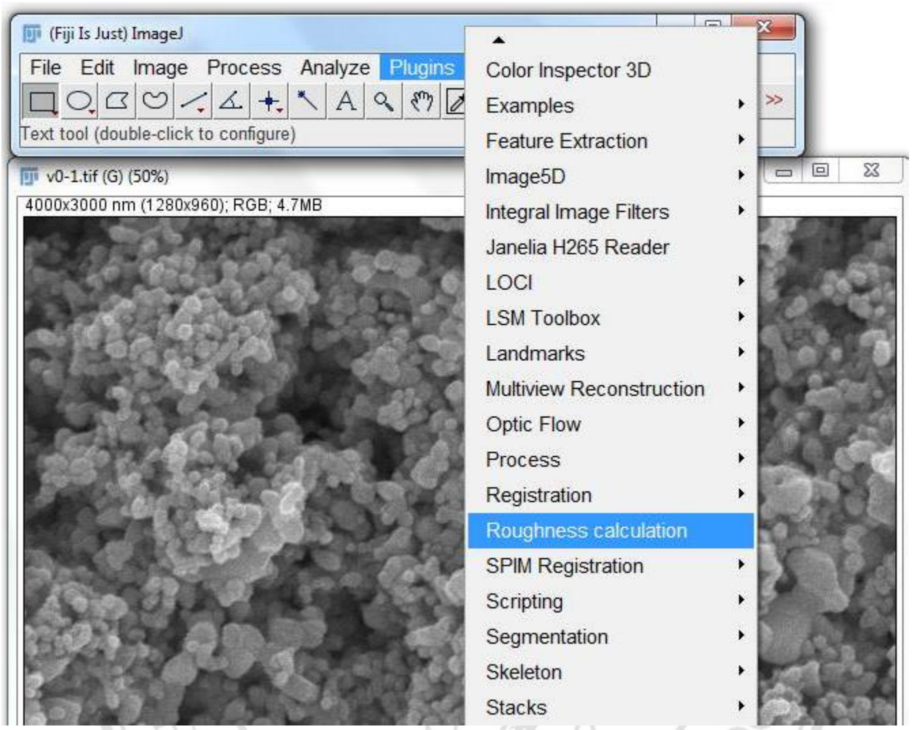

Figure A.9 The roughness calculation.

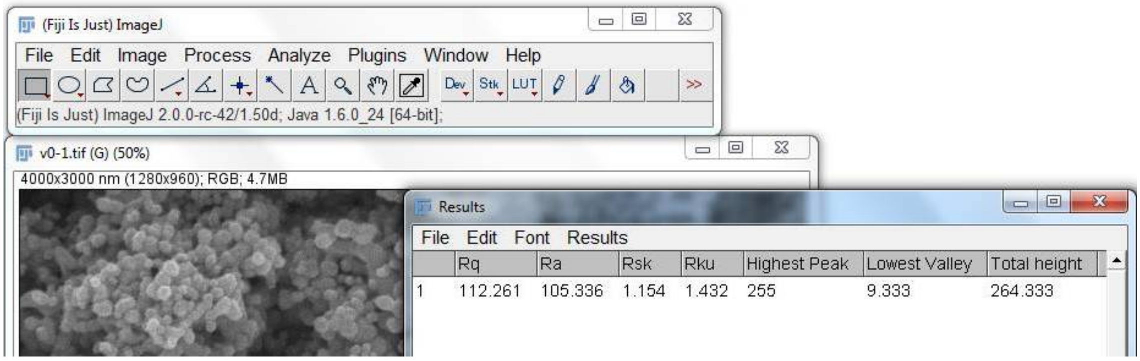

Figure A.10 The roughness data.

4. The mapping profile analysis

Before analyze the mapping surface, the ordinary image was selected with a rectangular tool for choosing target area. Next, the mapping profile was analyzed by using analyze tool (Analyze >> Plot Profile) as shown in figure A.11. The profile is obtained in both of graphic and raw data as shown in figure A.12.

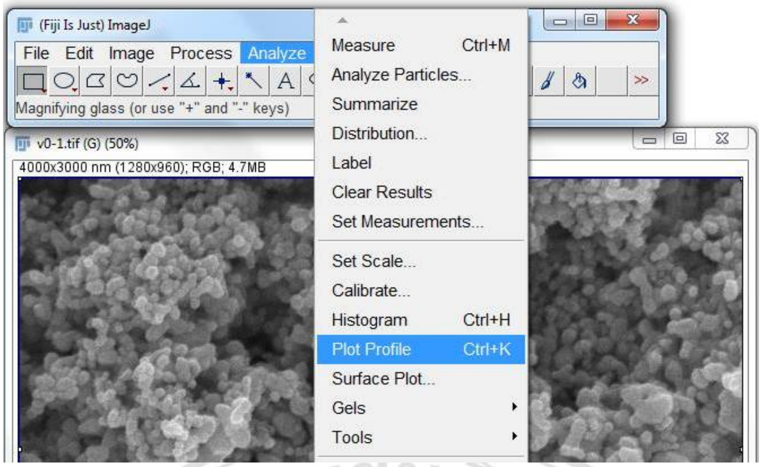

Figure A.11 The mapping profile analysis.

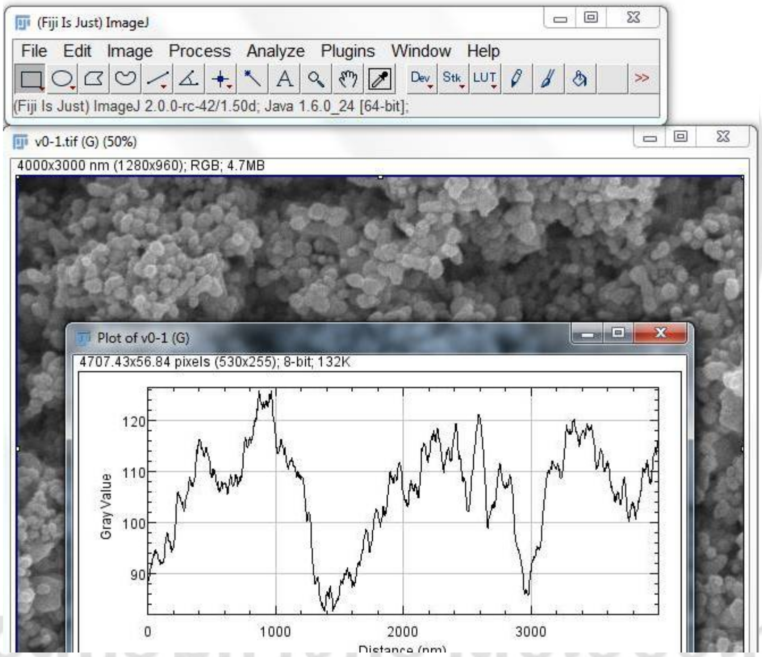

Figure A.12 The mapping profile result.

APPENDIX B

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Publications

1. **S. Sutthana**, C. Sae-Kung, S. Pratontep, P. Mangkorntong, N. Mangkorntong and S. Choopun, Electrical and Optical Properties of AZO/Ag/AZO Multilayer Thin Films Prepared by DC Magnetron Sputtering, Chiang Mai University Journal of Natural Science Special Issue on Nanotechnology 7(1) (2008) 105-111.
2. **S. Sutthana**, N. Hongsith, S. Choopun, AZO/Ag/AZO multilayer films prepared by DC magnetron sputtering for dye-sensitized solar cell application, Current Applied Physics 10 (2010) 813–816.
3. **S. Sutthana**, D. Wongratanaphisan, A. Gardchareon, S. Phadungdhitidhada, P. Ruankham, S. Choopun, Enhancement of ZnO Dye-sensitized Solar Cell Performance by Modifying Photoelectrode using Two-steps Coating-etching Process, Energy Procedia 79 (2015) 1021 – 1026.

4. C. Bhoomanee, S. Nilphai, **S. Sutthana**, P. Ruankham, S. Choopun, D. Wongratanaphisan, "Effect of Gallium Interlayer in ZnO and Al-doped ZnO Thin Films", Integrated Ferroelectrics, 165 (2015) 121-130.
5. **S. Sutthana**, D. Wongratanaphisan, A. Gardchareon, S. Phadungdhitidhada, P. Ruankham, S. Choopun, Enhancement of ZnO dye-sensitized solar cell performance by modifying photoelectrodes using an acid vapor texturing process, Surface and Coatings Technology, *In Press*.
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