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論文 / 著書情報
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題目(和文)	水溶液プロセスで作製した高い透明性および導電性を持つ酸化亜鉛膜
Title(English)	Solution-Processed Zinc Oxide Films Having High Transparency and Conductivity
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学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

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（博士課程）
Doctoral Program

論 文 要 旨

THESIS SUMMARY

専攻： Department of	物質電子化学 専攻	申請学位（専攻分野）： Academic Degree Requested	博士 Doctor of Engineering
学生氏名： Student's Name	HONG, JeongSoo	指導教員（主）： Academic Advisor(main)	Nobuhiro MATSUSHITA
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要旨（英文 800 語程度）
Thesis Summary（approx.800 English Words ）

In this thesis, solution-processed ZnO films were discussed.

In Chapter 1, general properties of ZnO and deposition method named spin-spray process were described. Spin-spray method is attractive fabrication method for preparing ZnO film. It is environmentally friendly, and construction is simple. The spin-spray method can fabricate the high quality ZnO film at low substrate temperature below 100^{o}C. Furthermore, deposition process is also very simple. Two kinds of solution such as source and reaction solution were sprayed on rotating and heated substrates, and then film was formed on substrate surface. Although, deposition process is simple, however, as-deposited films by spin-spray method had high transparency and crystallized without seed layer.

In Chapter 2, ZnO films having various structures such as rod array, dense, and flower-like structure were investigated. Rod array structure changed to dense structure by adding trisodium citrate in reaction solution, and flower-like structured ZnO film was simply obtained by change of *p*H adjusted from ammonia solution to sodium hydroxide. These various 1 dimensional and dense structures of ZnO films have various functional properties and they were expected to apply for various applications such as nano-generators, sensors, organic light emitting diodes, thin film transistors and solar cells.

In Chapter 3, effects of UV irradiation on conductivity of transparent ZnO film were investigated. As-deposited ZnO film by adding citrate ions in reaction solution had high transparency and dense structure, while it had low conductivity due to organic substance in the film. However, high carrier concentration (~10^{20} cm^{-3}) of ZnO films was achieved by UV irradiation. Under UV irradiation, organic substance in the ZnO films was decomposed by photocatalytic reaction of ZnO, C, and /or H doping into ZnO. As a result, many carriers were generated by ions doping. Additionally, it was also confirmed that UV condition having wide wavelength was more effective to decompose the organic substance in the film, and it resulted lower resistivity.

In Chapter 4, effect of hydrogen treatment on solution-processed ZnO films was also investigated. To improve the electron mobility, hydrogen treatment process was used before UV irradiation. Hydrogen treated and UV irradiated ZnO film had the lowest resistivity of 1.8×10^{-3} Ω·cm with high carrier concentration (1.5×10^{20} cm^{-3}), in case of mobility, it increased 10 times from 1.2 to 11.2 $cm^2V^{-1}s^{-1}$. Reason for high mobility might be desorption of negatively charged oxygen species on grain boundary by hydrogen treatment. This result supposed that pure ZnO film without metal ions doping such as aluminum and gallium could be applied to various applications as a transparent electrode due to their high conductivity.

In Chapter 5, ZnO films deposited on flexible substrate (PES) at 85^{o}C were reported. Generally, conventional solution processes requires the annealing process for crystallization, and high substrate temperature was necessary for removing organic substance in the film. On the other hand, while spin-spray method was solution process it could fabricate crystallized ZnO film without post-annealing process at low substrate temperature. ZnO films on PES substrate had low resistivity (9.1×10^{-3} Ω·cm) and high transmittance (above 85%), it was one of the good examples to utilize the advantage of spin-spray method.

In Chapter 6, heterostructured double layered films of Ferrite (α-Fe_2O_3 and Fe_3O_4)/ZnO were investigated. They successfully obtained by spin-spray method at low substrate temperature below 100^{o}C.

In Chapter 7, Future prospects were discussed. It was thought that as-fabricated ZnO films could be applied to p-n junction device and wearable devices.

In Chapter 8, this thesis was summarized.

備考 ： 論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。
Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).

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