Studies on fabrication of a fine structures of metal oxides by photochemical decomposition of organometallic compound thin film

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The dissertation surveys the fabrication of nanometer size fine structure. The current mainstream is the fabrication of semi-conductor fine structure, but the method of metal oxide fine structure of nm size fabricating is not established yet. Recently it were proposed two methods of the metal oxides nano structure fabrication :

(1) The fabrication of order arrangement nanosize structure by photochemical decomposition of epitaxial growth film.

(2) The fabrication of the nanosize structure on substrate, based on the large cohesive force of organometallic compound particle on any kind of substrates.

In order to realize these methods, the growth of metal stearate thin film was investigated. It was made clearly that the metal stearate film is mainly the stearone instead of metal stearate as it was thought before.

Photochemical decomposition behavior of zinc stearate epitaxial thin films grown on KCl have been investigated. UV light irradiation produced by the excimer lamp broke the intermolecular organic bond of zinc stearate. It gives the structural and morphological changes of the films. Optical measurements showed that the carbonyl group of zinc stearate is dissociated easier with respect to other organic bonds. It was confirmed that ZnO finally remains on substrate surface without volatilization after long-time irradiation of UV light as expected.

In order to fabricate the metal phthalocyanine thin film with large area flatly the substrate temperature dependence of the mean grain diameter in the vanadil phthalocyanine film with island structure was investigated. It became clear that the mean grain diameter of vanadil phthalocyanine thin film on alkali halides

substrate strongly depends on substrate temperature, increasing to 110℃, while decreasing at higher temperatures. The nucleus density decreased linearly with rising the substrate temperature which means that the growth mechanism is simple Volmer-Weber growth mode. Thus the mean grain diameter can be controlled by the initial nucleus density and therefore the substrate temperature.

Furthermore, the photochemical decomposition behaviors and the change of surface morphology for the vanadil phthalocyanine and cobalt phthalocyanine films irradiated by UV light have been investigated. As a result, It was found that the fine structure of the metal oxides with the size and configuration corresponding to the phthalocyanine grain before irradiation is formed as expected. the fine structures of vanadium oxide was found to exhibit a ferromagnetic magnetization depending on the grain size.

In conclusion, the applicability of the metal oxide fine structure fabrication method proposed in the dissertation was considered. The first method is effective for small area of the same size as usual devices. The second method can fabricate the metal oxide fine structure of arbitrary size. The methods proposed in the dissertation have big significance, because the next generation of devices with the new facilities can apply it.

Key words:

Photochemical decomposition reaction, metal oxide fine structure, metal stearate, metal phthalocyanine