Innovative Development of Production and Evaluation Technologies of Silicon Compounds and Their Thin Films for Advanced Fields

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Introduction

We have developed production technologies, analytical methods, and evaluation technologies of silicon compounds like disilane, hexachlorodisilane, polysilane, triethoxysilane etc. and commercialized first in the world. Furthermore, we have developed the deposition technologies using these compounds ourselves or jointly with device makers and equipment manufactures. Although these technologies have been adopted in the semiconductor, flat panel, solar cell industries. the advanced industries face to technological and scientific problems like Moore's law limits. In order to solve these problems, new processes based upon new materials are required. This project is aiming to propose keys for these solutions for the advanced fields by the innovative development of technologies for production and evaluation of silicon compounds and their thin films.

Experimental Procedures

We synthesized the higher silane having the below formula using Si_2Cl_6, hexachlorodisilane as a starting material following by [2]. This silane is estimated to have a Cage-like molecular structure.

$$Si_2Cl_6 \rightarrow [(C_4H_9)_4N]Si_{32}Cl_{45}$$

To investigate the molecular structure, the absorption and fluorescence spectra were measured and reported [4], [5], [6]. We found that it is soluble in propylene carbonate (PC) which is a polar solvent. The absorption spectrum in PC was measured and shown on Fig.1. The fluorescence spectrum was measured and shown on Fig.2. Since solvent was found, it was confirmed that film formation was possible by dipping or spin on glass. We constructed the LED structure using the higher silane having a cage-like structure containing Si32 and observed the electroluminescence.

Results and Discussion

The UV absorption and fluorescence spectra are estimated as derived from Si-Si bond networks. The film formation was possible by dipping or spin on glass. The electroluminescence was observed from the LED structure using the higher silane having a cage-like structure containing Si32.

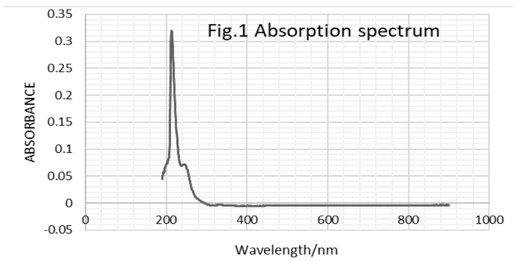

Figure 1. Absorption spectrum of the higher silane in PC.

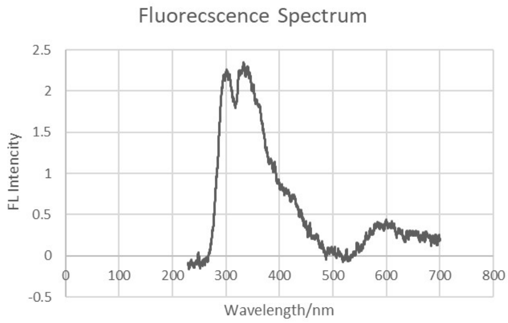

Figure 2. Fluorescence spectrum of the higher silane excited at 220 nm.

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References

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