LA-CRADA-97-0022

Title: Thiogallate Blue Phosphors for Thin Film Electroluminescent Flat Panel Displays

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Final Report

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FINAL ABSTRACT

CRADA TITLE: Thiogallate Blue Phosphors for Thin Film Electroluminescent Flat Panel Displays

CRADA NUMBER: LA95C10192

This project helped to develop a metal-organic chemical vapor deposition (MOCVD) method that could improve the efficiency of the blue phosphor for full color thin-film electroluminescent (TFEL) flat panel displays. High quality SrS and SrS:Ce thin films were deposited from Sr(thd)2, Ce(thd)4 and H2S via a low pressure MOCVD process. Film characteristics were found to be insensitive to the presence of the cerium dopant in the concn. range investigated. Depositions were carried out for a wide temp. range (250-550°C). Deposition rates were found to be relatively insensitive for the temp. range investigated. The films produced were found to be highly cryst. at all temps. investigated. Deposited material showed texturing as a function of substrate material and temp. FWHM of the á111ñ reflections were found to have a 2Q values of 0.15-0.18 deg. for all temps. RBS and AES shows stoichiometric 1:1 SrS with less than 2% carbon and oxygen contaminates. ERD indicates the films to have 1-2.5% hydrogen. Films doped with 0.019-0.043 atom % Ce showed weak blue-green to green PL with increasing dopant concn. Doped films yielded up to 3.2 cd/m2 EL emission with CIE coordinates of x = 0.22 and y = 0.32 and turn-on voltages of 150-250 V.

Thiogallate Blue Phosphors for Thin Film Electroluminescent Flat Panel Displays

FINAL REPORT

CRADA No. LA95C10192

A. Parties

The project is a relationship between Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, New Mexico 87545 and

Planar Systems Inc.
1400 NW Compton Dr.
Beaverton, OR 97006

B. Project Scope

The overall goal of this project was to develop a metal-organic chemical vapor deposition (MOCVD) method that would improve the efficiency of the blue phosphor for full color thin-film electroluminescent (TFEL) flat panel displays. A modification from the original project was agreed to that focused efforts on the growth of the SrS:Ce phosphor material.

C. Technical

High quality, crystalline SrS material was deposited on a number of substrates at temperatures from 310 to 550°C. Carbon and oxygen contents of the films were below the detection limits for Auger analysis (less than 1 atomic percent). The thin films showed preferred orientations that vary with substrate temperature. This variation can be understood from the growth mechanism. Cerium doping did not produce the desired results. Film performance was below (less than half the L_{40} luminance value) that of the Atomic Layer Epitaxy method. The doping could not be accurately controlled with the traditional bubbler delivery system. Follow on work, under a different program, is currently addressing this issue by using a liquid delivery system.

D. Partner Contributions

Planar provided all of the substrates for this project and fabricated the TFEL devices for testing. All of the agreed to deliverables were met. They are continuing to pursue MOCVD as a possible manufacturing method for their product. No subject inventions have been created during the CRADA project by the industrial partner.

E. Documents/Reference List

No documents were generated.

F. Acknowledgment

Industrial Partner's signature on the final report indicates the following:

1) The Participant has reviewed the final report and concurs with the statements made therein;
2) The Participant agrees that any modifications or changes from the initial proposal were discussed and agreed to during the term of the project;
3) The Participant certifies that all reports either completed or in-process are listed and all subject inventions and the associated intellectual property protection measures attributable to the project have been disclosed or are included on a list attached to this report;
4) The Participant certifies that proprietary information has been returned or destroyed by Los Alamos National Laboratory.

Richard T. Tuenge 4/11/97
Richard T. Tuenge Date

Robert C. Dye 4/30/97
Robert C. Dye Date