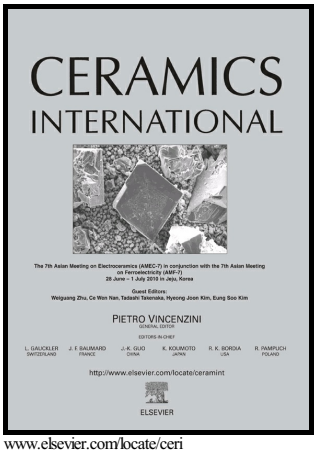

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P-type transparent LaCuOS semiconductor synthesized via a novel two-step solid state reaction and sulfurization process

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Abstract

A novel and simple two-step preparation method has been successfully developed to synthesize high quality oxychalcogenide LaCuOS, a direct-gap p-type transparent semiconductor. We first successfully synthesized $CuLaO_2$ using cheap Cu_2O and La_2O_3 via solid state reaction, and then achieved high quality LaCuOS through sulfurization at an optimum temperature of 860°C without using conventional hazardous H_2S or CS_2 gas. With the use of easily available and relatively more stable starting materials of Cu_2O, La_2O_3 and S, this method is less costly than conventional solid state reaction route for obtaining oxychalcogenides. The synthesized LaCuOS of high purity has a band gap of 3.1eV and gives a resistivity of 0.25MΩ.cm and high seebeck coefficient of +515μV/K. Moreover, it demonstrates strong luminescence at room temperature. The success of this novel two-step synthesis method also opens a door for environmental friendly synthesis of other high performance oxychalcogenides.

Keywords

P-type TCO; oxychalcogenide; transparent semiconductor; sulfurization; LaCuOS

1. Introduction

Optoelectronics is one of the most important electronics in our daily life. Transparent semiconductor oxides (TSOs) play a crucial role in optoelectronics. Over the past few decades,