

Experimental study of lanthanum boride ceramic powder synthesis process

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Abstract. In this paper, the physical and chemical properties of LaB₆ Ceramics are introduced, the influence of fabrication techniques on the microstructure and properties of LaB₆ Ceramics are discussed. The combustion synthesis process was considered as the proper method for fabrication of LaB₆ Ceramic powder with high purity. The results showed that the control additive has a great influence on the synthesis process and the nano LaB₆ Ceramic powder with high purity can be produced made when the content of the control additive is 30%.

Introduction

LaB₆ (Lanthanum Boride) is a compound of rare earth metal element La and nonmetal element B. The LaB₆'s crystal structure is of simple cubic, and the B atoms encircle lanthanum atoms to form an octahedral structure. From the view of crystallography that LaB₆'s structure can be understood as the boron atom octahedron forms a stable 3 d boron skeleton, and La atoms are located in the structure voids (Fig 1). B atoms combined by covalent bond, and La atoms donate electrons for the lack of bonding electronically, for there are 3 La atoms' valent electrons and 2 donate electrons. Therefore, LaB₆ ceramics has good electrical conductivity by the crystal structure [1].

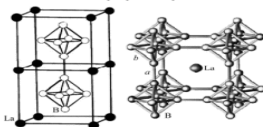


Fig. 1 The crystal structure of LaB₆

LaB₆ ceramics has high melting point, high strength, and high hardness. Nonmetal refractory compounds usually have such characteristic due to strong covalent bond between B atoms. The free electrons in LaB₆ structure also give it good electric and thermal conductivity like metals [2]. In addition, LaB₆ has high chemical stability, only reacts with aqua regia and nitric acid at room temperature and low oxidation between 600 °C and 900 °C. LaB₆ material also has many special characteristics: (1) low electric work function, excellent resistance to the radioactive; (2) Low expansion coefficient—close to 0 in a certain temperature range; (3) good stability in air; (4) high resistance against ion bombardment; (5) Pure boron ion can be obtained with LaB₆ as the cathode to create a strong and stable ion source.

It is found that the electron emission performed by the LaB₆ ceramics is better than that by the oxidation of fluorium cathode, thorium-tungsten, and has a special cathode with strong anti poisoning capability, boron frame structure, good resistance against ion bombardment, also can adjust the

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