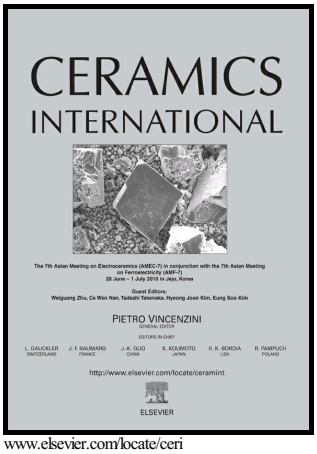

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LANTHANUM CERATE THERMAL BARRIER COATINGS GENERATED FROM THERMAL PLASMA SYNTHESIZED POWDERS

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Abstract

Lanthanum cerate ($La_2Ce_2O_7$, LC) is one of the promising advanced thermal barrier coating (TBC) materials due to its high melting point, no phase transformation between room temperature and operating temperature, low thermal conductivity, comparable coefficient of thermal expansion (CTE) with metallic substrate. The present study investigates plasma transferred arc synthesis of LC powder, its subsequent spheroidization in a thermal plasma jet and plasma spray deposition. The PTA-synthesized LC powder, spheroidized as well as the plasma sprayed coatings was found to possess excellent phase stability; the single phase cubic fluorite structure of LC was found to be retained even after prolonged arc-melting, corroborating that the material was stable from room temperature up to its melting point. It was observed that PTA melting for longer duration resulted in small deviation from stoichiometry, although the phase structure of LC was retained. Spheroidization efficiency was found to increase with the input power of the torch. Very good adherent LC coatings could be deposited on nickel super alloy with reasonably good deposition efficiency.

Keywords: Lanthanum Cerate; Thermal Barrier Coatings; Plasma Transferred Arc; Chunks; Spheroidization;

1. Introduction

Thermal plasma technology is used for a variety of applications including material synthesis, plasma spray deposition, waste treatment, cutting, etc. [1]. The most widely used application of thermal plasmas is plasma spray deposition of ceramics and metals for thermal barrier and corrosion barrier applications. Metal and ceramic powders for plasma spray deposition should possess very good flow characteristics to ensure good deposition efficiency and improved coating properties. In view of their excellent flow-ability, spherical particles are preferred to irregularly shaped particles. Spray drying and gas atomization processes are commonly used for producing spherical particles. Plasma processing is the latest entry with many advantages such as large throughput, better efficiency and adaptability. Processing of ceramic particles in plasma medium leads to the formation of particles with spherical morphology possessing good flow characteristics, which is essential for thermal spray applications [2].

Plasma sprayed ceramic coatings are used as thermal barrier in hot sections of gas turbines and aero turbine components to improve their life time, increase engine efficiency and protect the base material from high temperature and corrosion. Thermal barrier coatings (TBCs) consist of a metallic bond coat (MCrAlY, M= Ni, Co or both) and ceramic topcoat [3,