Paper ID: 26117
poster

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Specialised Technologies, Including Nanotechnology (8)

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SMART RADIATION DEVICES FROM NANOSTRUCTURED CERAMICS

Abstract

The Smart Radiation Device (SDR) is a new active thermal control device composed by manganese oxide based ceramics with perovskite-type structure. These materials have been developed in a attempt to maintain the interior of the satellite at a temperature suitable for sensitive on-board equipments. These materials have colossal magneto-resistance properties and shows a phase transition from ferromagnetic metal to paramagnetic insulator at around room temperature. They have a strong temperature dependence on the electrical resistivity that promotes a temperature dependence of the total hemispherical emittance (εH). The use of this thermal control device reduces the energy consumption of the on-board heater, and decreases the weight and the coast of thermal control system on artificial satellites. In this work are presented the results and discussion about the relationships between H and temperature for two SDR composed by lanthanum magnetite doped with calcium and strontium, La1xSrxMnO3 (LSMO compound and x= 0,33) and, La1yCayMnO3 (LCMO compound and y = 0,33), respectively. The nanostructured monolithic ceramics were produced from sol-gel process, conformed in rod shapes and sinterized at 1100 oC. The X-rays diffraction (XRD) investigation showed that all the ceramics were compose of 100 % of chemical compound perovskite-type structure. The changes of total hemispherical emittance as function of temperature, were obtained from measurements inside a thermal-vacuum chamber under environmental space conditions. The results showed that εH increases monotonously with increasing temperature and have a temperature-dependent metal–insulator transition near to room temperature. The relationship between εH and temperature of the nanostructured LSMO and LCMO ceramics make them attractive as candidate material for future satellite active thermal control.