THE SUMMARY OF Ph. D. DISSERTATION

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Title

Improved Performance in Infrared Bolometric Material Lanthanum Manganite

Abstract

Infrared sensors are used for a night monitoring, an astronomical observation, a medical treatment and a building diagnosis, and so on. Uncooled infrared sensors function at near-room temperature without a cooling system, so the uncooled infrared bolometer is small and portable. A bolometric sensor (which is one of the uncooled infrared sensor) is excellent in the sensitivity and consists of the simple structure. Thus, the bolometric sensor is considered to be a user-friendly sensor in the future. It is required for the bolometric material to have a large temperature coefficient of resistance (TCR) near room temperature.

Our purpose is to obtain new material whose performance surpasses a living bolometrc material vanadium oxide (VO_x), and our objective materials are lanthanum manganite systems $La_{1-x}A_xMnO_3$ (LAMO : A=Ca, Sr, Ba). LAMO systems transfers from paramagnetic insulator to ferromagnetic metal near room temperature. And it shows a large TCR near this transition temperature. LAMO films are deposited by a laser ablation (LA) method and estimated their bolometric performances.

There are two characteristics in this study. The first is that the LA method have been used as a film deposition method. The other is that bismuth-substituted LAMO films have been formed for bolometric material. The temperature dependence of resistance in LAMO systems is greatly changed by the oxygen stoichiometry. In the LA method, oxygen pressure under deposition can be controled some extent freely. So, it is possible to change TCR by setting oxygen pressure. There are some $La_{0.7}Ba_{0.3}MnO_3$ (LBMO) thin films whose TCRs are over 3%/K near room temperature. But $SrTiO_3$ substrate (whose lattice constant is nearly LBMO's) and annealing at 900 ℃ are needed for LBMO thin films to indicate large TCRs. A bolometric thin film must be formed on SiO_2 thin film at temperatures lower than 500 ℃.

When a bismuth-substituted La-Sr-Mn-O (BLSMO) thin film is deposited at 400 ℃, the BLSMO thin film shows a large TCR above 3%/K. A microbolometer is fabricated with the BLSMO thin film and shows good performances in TCR, responsivity and noise equivalent temperature difference. It is clarified the performance of the BLSMO microbolometer greatly surpasses that of the living VO_x bolometer.