

Studi Pengaruh Medan Magnet pada Panas Jenis Temperatur Rendah Untuk $\text{La}_{0,5}\text{Ca}_{0,5}\text{Mn}_{1-x}\text{Cu}_x\text{O}_3$ ($x=0,05; 0,15; 0,2$)

Tri Indrastuti, author

Deskripsi Lengkap: <https://lib.ui.ac.id/detail?id=20236268&lokasi=lokal>

Abstrak

Analisa panas jenis pada temperature rendah untuk $\text{La}_{0,5}\text{Ca}_{0,5}\text{Mn}_{1-x}\text{Cu}_x\text{O}_3$ ($x = 0,05; 0,15; 0,2$) dilakukan dengan menggunakan PPMS (Physical Properties Measurement System) SQUID Quantum Design di Tanaka Lab, Department of Physics, Tokyo Institute of Technology Jepang. Sampel $\text{La}_{0,5}\text{Ca}_{0,5}\text{Mn}_{1-x}\text{Cu}_x\text{O}_3$ ($x = 0,05; 0,15; 0,2$), merupakan campuran dari bahan dasar La_2O_3 , CaCO_3 , MnO_2 dan CuO dalam bentuk serbuk dibuat sesuai dengan perhitungan reaksi kimia. Cara membuat sampel $\text{La}_{0,5}\text{Ca}_{0,5}\text{Mn}_{1-x}\text{Cu}_x\text{O}_3$ ($x = 0,05; 0,15; 0,2$) dengan penggerusan secara ball mill. Setelah di ball mill diuji dengan XRD (X-Ray Difraktometer) untuk mengetahui struktur kristalnya. Hasil dari pengujian XRD masing-masing sampel memiliki struktur kristal orthorombik dan space group Pnma. Panas jenis pada sampel $\text{La}_{0,5}\text{Ca}_{0,5}\text{Mn}_{1-x}\text{Cu}_x\text{O}_3$ ($x = 0,05; 0,15; 0,2$) menunjukkan suatu anomali pada temperatur 144 K ketika medan magnetik 0 dan 9 T. Untuk menganalisis panas jenis digunakan suhu kisaran 3 K - 31 K. Suhu Debye dari sampel $\text{La}_{0,5}\text{Ca}_{0,5}\text{Mn}_{0,95}\text{Cu}_{0,05}\text{O}_3$ sebesar 364,8890 K sedangkan sampel $\text{La}_{0,5}\text{Ca}_{0,5}\text{Mn}_{1-x}\text{Cu}_x\text{O}_3$ ($x = 0,15$ dan $0,20$) sebesar 459,7314 K. Energi fermi dari sampel $\text{La}_{0,5}\text{Ca}_{0,5}\text{Mn}_{1-x}\text{Cu}_x\text{O}_3$ ($x = 0,05; 0,15; 0,2$) masing-masing sebesar $3,5256 \times 10^{24}$ /eV.mol, $1,1267 \times 10^{25}$ /eV.mol, dan $1,7117 \times 10^{25}$ /eV.mol tanpa medan magnetik sedangkan yang dipengaruhi medan magnetik 9 T sebesar $1,1216 \times 10^{25}$ /eV.mol dan $1,5457 \times 10^{25}$ /eV.mol. Dengan nilai x semakin besar maka energi ferminya juga semakin besar. Dari hasil pencocokan persamaan panas jenis diperoleh bahwa kontribusi lattice sangat mempengaruhi. Di bawah 51 K, diperoleh data panas jenis untuk sampel $\text{La}_{0,5}\text{Ca}_{0,5}\text{Mn}_{1-x}\text{Cu}_x\text{O}_3$ ($x = 0,05; 0,15; 0,2$) dapat diterapkan hukum exponential decay. Hasil dari exponential diperoleh energi gap sebesar 5,178 meV.

.....Specific heat analysis at low temperature for $\text{La}_{0,5}\text{Ca}_{0,5}\text{Mn}_{1-x}\text{Cu}_x\text{O}_3$ ($x = 0,05; 0,15; 0,2$) has been done by using PPMS (Physical Properties Measurement System) SQUID QUANTUM DESIGN in Tanaka Lab, Department of Physics, Tokyo Institute of Technology Jepang. Sample $\text{La}_{0,5}\text{Ca}_{0,5}\text{Mn}_{1-x}\text{Cu}_x\text{O}_3$ ($x = 0,05; 0,15; 0,2$), be mixture from base material La_2O_3 , CaCO_3 , MnO_2 and CuO in the form of powder is made as according to calculation of chemical reaction. The sample $\text{La}_{0,5}\text{Ca}_{0,5}\text{Mn}_{1-x}\text{Cu}_x\text{O}_3$ ($x = 0,05; 0,15; 0,2$) is mode by Ball Mill. After that, the sample is tested with XRD (X-Ray Diffractometer) to know the crystal structure. Result from assaying of XRD show that each sample has crystal structure of orthorhombic and space group of Pnma. Sample $\text{La}_{0,5}\text{Ca}_{0,5}\text{Mn}_{1-x}\text{Cu}_x\text{O}_3$ ($x = 0,05; 0,15; 0,2$) shows an anomaly at 144 K when magnetic field 0 and 9 T are induced. We analyze specific heat at temperature range of 3 K - 31 K. Debye temperature of sample $\text{La}_{0,5}\text{Ca}_{0,5}\text{Mn}_{0,95}\text{Cu}_{0,05}\text{O}_3$ is 364,8890 K of sample $\text{La}_{0,5}\text{Ca}_{0,5}\text{Mn}_{1-x}\text{Cu}_x\text{O}_3$ ($x = 0,15$ and $0,20$) is 459,7314 K. Fermi dissociation energy of diatomic of sample $\text{La}_{0,5}\text{Ca}_{0,5}\text{Mn}_{1-x}\text{Cu}_x\text{O}_3$ ($x = 0,05; 0,15; 0,2$) are $3,5256 \times 10^{24}$ /eV.mol, $1,1267 \times 10^{25}$ /eV.mol, and $1,7117 \times 10^{25}$ /eV.mol without magnetic field while influenced by magnetic field 9 T are $1,1216 \times 10^{25}$ /eVmol and $1,5457 \times 10^{25}$ /eV.mol. With greater x value hence the Fermi dissociation energy of diatomic is also greater. From specific heat theoretical analysis it is obtained that contribution lattice is hardly

dominated. Below 51 K, specific heat of $\text{La}_{0,5}\text{Ca}_{0,5}\text{Mn}_{1-x}\text{Cu}_x\text{O}_3$ ($x = 0,05; 0,15; 0,2$) show an exponential decay. Resulting from dissociation energy of diatomic 5,178 meV.