Large magnetoresistance in oxygen deficient $SrTiO_3$

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Abstract

Ordinary magnetoresistance in metal has been intensively investigated so far [1]. Large magnetoresistance is uncommon phenomena, it has been observed in semimetallic system, such as bismuth [2].
Galvanomagnetic transport properties in oxygen deficient $SrTiO_3$ were investigated. To create oxygen vacancies, $SrTiO_3$ single crystals were annealed at high temperature in vacuum environment (< 10^{-8} Torr). As annealing temperature increased resistivity was decreased, it means that higher annealing temperature cause much more oxygen vacancies in $SrTiO_3$ single crystals. Interestingly, non-linear Hall resistivity and magnetoresistance were observed under 100 K simultaneously as seen in Figure 1, which is frequently observed in two band-model [3]. As temperature decreased to 2 K, magnetoresistance increased up to about 3,000 %. Transport properties were well fitted by two band-model, electron-like carrier density and mobility were well matched with obtained by conventional Hall effect. The other type of carriers appeared about at 100 K and become influential as temperature decreased. Detailed parameters are shown in Figure 2. In order to find the origin of large magnetoresistance in oxygen deficient $SrTiO_3$, electrical and optical measurements have been conducted.

References

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[2] Yang, F. Y. et al. *Large magnetoresistance of electrodeposited single-crystal bismuth thin films*. Science 284, 1335 (1999)
[3] Wang, L. *et al.* Tuning magnetotransport in a compensated semimetal at the atomic scale. *Nat. Commun.* 6, 8892 (2015)

Figures

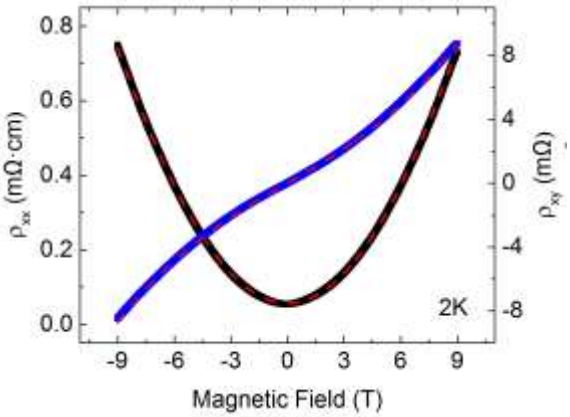

Figure 1. Resistivity (black line) and Hall resistivity (blue line) in oxygen deficient $SrTiO_3$ at 2K. Red dotted lines are fitted by two-band model.

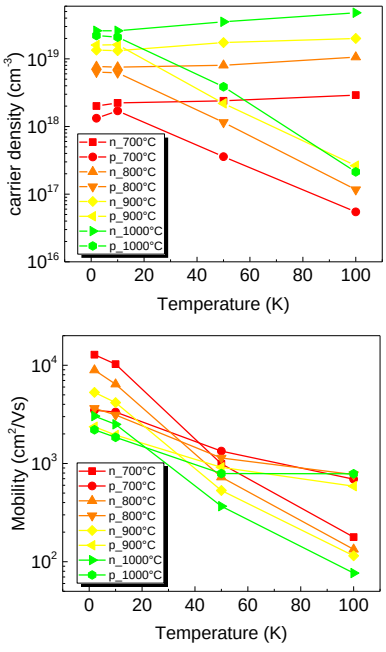

Figure 2. Extracted parameter of (a) carrier density and (b) mobility from two-band model.