EMR Study of a Possible Topological Kondo Insulator SmB_6

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Introduction

In Kondo insulator samarium hexaboride SmB_6, strong correlation and band hybridization lead to an insulating gap and a diverging resistance at low temperature. However, unlike in other Kondo insulators, the resistance of SmB_6 saturates below about 4 K. Recently, it was proposed that SmB_6 may be a three-dimensional topological Kondo insulator where the topologically non-trivial insulating state is produced by the hybridization between conduction band and coherent 4f band [1, 2].

Here, we performed EMR measurements on SmB_6 with the goal to explore the possible topological surface states in this material. Because the gap of SmB_6 is on the order of 10 meV, EMR carried out at micro/mm wave frequencies is a suitable technique for probing the surface states of this material.

Experimental

EMR experiments were performed at NHMFL with a 12 T SC magnet at 240 GHz frequency. Samples were grown at UCI. We investigated undoped SmB_6 samples as well as doped ones.

Results and Discussion

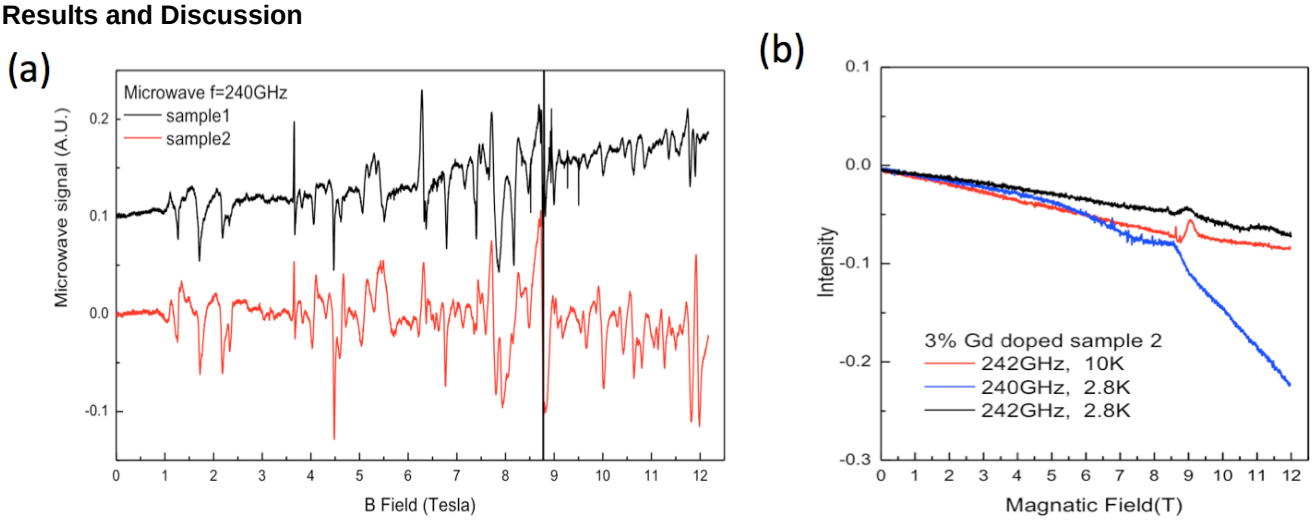

Figure 1: (a) EMR data for undoped SmB_6 samples. (b) data for doped SmB_6 samples.

Figure 1 shows our preliminary data on doped and undoped samples. The undoped samples show many sharp resonance lines in the EMR spectra, which could be due to impurity states or possibly surface states of SmB_6. As shown in panel (b), the most dramatic effect is the suppression of the sharp lines in the entire field range by Gd or Yb doping compared to undoped samples. The almost total suppression of the sharp lines by doping is unexpected, since it is hard to explain why Gd or Yb doping can suppress all "impurity lines". More measurements will be performed to study this issue.

Conclusions

Our preliminary EMR data on doped and undoped SmB_6 samples show a very interesting contrast, which may provide new insights in the possible surface states of SmB_6.

References

[1] Dzero, M., *et al.*, Phys. Rev. Lett., **104**, 106408 (2010)
[2] Wolgast, S., *et al.*, Phys. Rev. B, **88**, 180405(R) (2013)