北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Special Seminar

Synthesis and superconductivity in RV_2Al_{20} and $CaBi_2$

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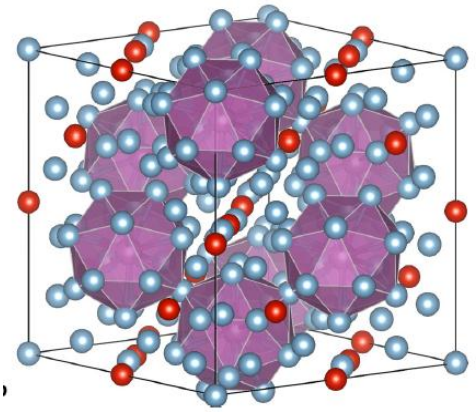
Time: 4:00pm, August 27th, 2018 (Monday)

时间: 2018年8月27日 （周一）下午4:00

Venue: w563, Physics building, Peking University

地点：北京大学物理楼，西563报告厅



Crystal structure of REV_2Al_{20} cage type compounds

Abstract

Series of compounds with the stoichiometry RV_2Al_{20} (R=rare earth) were synthesized by arc melting method in a high purity Ar atmosphere. The lattice constant, determined from Rietveld refinement, increases with increasing radii of the rare earth metal, which is located inside a CN16 Frank-Kaspar polyhedra formed by 16 Al atoms. The smallest a =1.44978 nm is observed for ScV_2Al_{20}, whereas the largest lattice parameter a = 1.4617 nm is observed for LaV_2Al_{20}. We used magnetic susceptibility, resistivity, and heat capacity measurements to characterize the superconducting state in MV_2Al_{20}, where M = Sc, Y and Lu. Superconducting critical temperature is 1.0 K, 0.57 K and 0.6 K for ScV_2Al_{20}, YV_2Al_{20}, LuV_2Al_{20}, respectively. Influence of the size of M atom (rattling effect) on superconductivity in this important class of materials will be discussed [1].

$CaBi_2$ single crystals were grown by self-flux method [2]. The energy-dispersive spectroscopy (EDS) yielded a Ca:Bi ratio of 1:2, and the powder X-ray diffraction confirmed the $ZrSi_2$–type crystal structure of the samples. The crystals were studied by means of magnetic susceptibility and heat capacity measurements. The experimental results suggest that $CaBi_2$ is a moderate coupling type-I superconductor. Calculations of the electronic structure revealed a mixed quasi-2D and 3D character of the Fermi surfaces, which reflect the layered character of the crystal structure. Preliminary spectroscopic results suggest the presence of the topological nodal line states in freshly cleaved $CaBi_2$ single crystal [3].

References

[1] M.J. Winiarski *et al*. Phys.Rev. B **93** (2016) 134507

[2] M.J. Winiarski *et al*. Phys.Chem.Chem.Phys. **18** (2016) 21737

[3] G. Dhakal *et al*. – in preparation

About the Speaker

Tomasz Klimczuk is an Associate Professor of Applied Physics and Mathematics in Gdansk University of Technology (Poland). He received his Ph.D. in physics in Gdansk University of Technology in 2001 and then worked as a assistant professor there till 2013. During the time he also worked as a postdoctoral Fellow in Leiden University, Princeton and Los Alamos. Tomasz Klimczuk has dedicated himself into searching new superconductors for over 15 years. He has over 150 publications.

Website for more information: http://www.mif.pg.gda.pl/homepages/tomek