Chemical and Physical Pressure Studies of Phosphorous Substituted $BaFe_2As_2$

Lina E. Klintberg[a], S. K. Goh[a], Y. Nakai[c, b], S. Kasahara[d], K. Ishida[c, b], Y. Ihara[b], M. L. Sutherland[a], Y. Shibauchi[b], Y. Matsuda[b], and T. Terashima[d]

[a]Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom
[b]Department of Physics, Graduate School of Science, Kyoto University, Kyoto 606-8502, Japan
[c]TRIP, JST, Sanbancho Building, 5, Sanbancho, Chiyoda, Tokyo 102-0075, Japan
[d]Research Center for Low Temperature and Materials Sciences, Kyoto University, Kyoto 606-8502, Japan

Replacing arsenic by phosphorous in $BaFe_2As_2$ induces superconductivity without introducing extra charge carriers; this isoelectronic substitution emulates the effect of physical pressure and is consequently known as chemical pressure. Applying physical pressure on substituted $BaFe_2(As_{1-x}P_x)_2$ therefore provides an interesting way to compare and contrast the interplay between chemical and physical pressure. We have performed AC susceptibility measurements on $BaFe_2(As_{1-x}P_x)_2$ under hydrostatic pressure and found a maximum T_c of 31 K for all combination of chemical and physical pressures. [1] Additionally, we have studied the anisotropic superconducting properties of the optimally substituted $BaFe_2(As_{1-x}P_x)_2$ with x = 0.35, and found that the superconducting properties become more anisotropic under pressure despite a decreasing T_c. [2]

[1]L. E. Klintberg, S. K. Goh et al., J. Phys. Soc. Jpn. 79, 123706 (2010)
[2]S. K. Goh, Y. Nakai et al., Phys. Rev. B 80, 094502 (2010)