Optical Study of the New Iron Selenide $K_{0.83}Fe_{1.53}Se_2$ Single Crystals

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The recent discovery of superconductivity with T_c exceeding 30 K in $K_xFe_2Se_2$ has attracted much attention of the scientific community[1]. Since the superconductivity in ternary iron selenide is in close proximity to the insulating phase[2], identifying the nature of the insulating parent compound becomes an essential step towards understanding the mechanism of the newly found superconductivity. Therefore, we perform infrared spectroscopy investigation on single-crystalline $K_{0.83}Fe_{1.53}Se_2$ samples[3]. The optical spectra indicate that this insulating parent compound should be considered as a small band gap semiconductor. Moreover, the infrared spectra of $K_{0.83}Fe_{1.53}Se_2$ single crystals show two peculiar features which are absent in all other iron-pnictides/chacogennides: a double peak structure between 4000-6000 cm^{-1} and abundant phonon modes much more than those expected for a standard 122 structure. We elaborate that the two peculiar spectral features could be naturally explained from the blocked anti-ferromagnetism[2] due to the presence of iron vacancy ordering.

References:
[1] Jiangang Guo et al. Phys. Rev. B **82**, 180520 (**R**) (2010)
[2] Wei Bao et al. Arxiv:1102.3674
[3] Z. G. Chen et al. Phys. Rev. B **83**, 220507 (**R**) (2011)