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High-Tc Superconductivity and Raman Scattering Study of the phonon properties of electron doped (transition metal, rare-earth) - Oxygen-Free CaFeAsF and compared with RFeAsO system. KALYAN SASMAL, VIKTOR HADJIEV, C.W(PAUL) CHU, Texas Center for Superconductivity Dept of Physics, University of Houston,TX, USA — Quaternary CaFeAsF has ZrCuSiAs-type structure,$(RO)^{\delta+}$ layer in RFeAsO replaced by $(CaF)^{\delta+}$ layer,with tetragonal ($P4/nmm$)-orthorhombic ($Cmma$) phase transition at 134K,while magnetic order,SDW sets in at 114K. Partial replacement of Fe with Co/Ni is direct electron doping to $(FeAs)^{\delta+}$ layer.Tc ˜15K in $CaFe_{0.9}Ni_{0.1}AsF$.Substitution of rare earth metal for alkaline earth metal suppresses anomaly in resistivity & induces superconductivity.Tc ˜52K in $Ca_{0.5}Pr_{0.5}FeAsF$.Characterized by resistivity, susceptibility,XRD & EDX-SEM.Upper critical field estimated from magneto resistance.Bulk superconductivity proved by DC magnetization. Hall coefficient R_H revealed hole-like charge carriers in parent compound CaFeAsF, while electron-type (R_H in normal state is –Ve) for $Ca_{0.5}Pr_{0.5}FeAsF$.Evolution of Raman active phonons of $Ca_{1-x}Pr_xFeAsF$ measured with polarized Raman spectroscopy at room temperature from ab surfaces of impurity-free microcrystals.Spectra exhibit sharp phonon lines on very weak electronic scattering background.Frequency and symmetry of Raman phonons involving out-of-plane atomic vibrations are found at 162.5 cm^{-1} ($A1g$, Pr), 201 cm^{-1} ($A1g$, As), 215.5 cm^{-1} ($B1g$, Fe), 265 cm^{-1} (Eg, Fe) and 334 cm^{-1} ($B1g$, F) for $Ca_{0.5}Pr_{0.5}FeAsF$.Observations are compared with RFeAsO unconventional superconductors also possibly related to magnetic fluctuations

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