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Microstructure and the non-bulk superconductivity up to 49K in electron-doped Rare-earth (Ca, R)Fe_2As_2 (R=La, Ce, Pr and Nd) Single Crystals BING LV, FENGYAN WEI, LIANGZI DENG, YANYI SUN, YU-YI XUE, MELISSA GOOCH, TCSUH and Department of Physics, University of Houston, JAMES MEEN, TCSUH and Department of Chemistry, University of Houston, CHING-WU CHU[1], TCSUH and Department of Physics, University of Houston — In an attempt to raise the Tc in the 122 family, we have carried out electron-doping and observed an onset Tc up to 49K in the single crystalline (Ca, R)Fe_2As_2 (R=La, Ce, Pr and Nd). The single crystals up to 5 x 5 mm size are grown from self-flux technique and the optimal doping parameters for different rare-earth elements will be reported. Magnetic and resistivity data suggest possible existence of two superconducting transitions in all the rare-earth electron doped (Ca, R)Fe_2As_2 samples: one starts at ∼40s K, and the other at ∼20K, with drastically different response to the field. Detailed single crystals diffraction analysis show that there are no significant difference in terms of atomic position, bond distances, angles and lattice parameters upon different rare earth doping; the defect-related local structure might be responsible for the observed high Tc in this system. The unusual superconducting phase appears to be filamentary or interfacial in nature, and the possible mechanism will be discussed.

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