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Temperature-concentration phase diagram and multigap superconductivity revealed by soft point-contact spectroscopy in (Ca $_{1-x}$ La$_x$)$_{10}$(Pt$_3$As$_8$)(Fe$_2$As$_2$)$_5$ NI NI, Los Alamos National Lab, EUNSUNG PARK, Los Alamos National Lab & Department of Physics, Sungkyunkwan University, WARREN E. STRASZHEIM, Department of Physics and Astronomy, Iowa State University, XIN LU, DARRICK J. WILLIAMS, Los Alamos National Lab, MAKARIY A. TANATAR, RUSLAN PROZOROV, Department of Physics and Astronomy, Iowa State University, ERIC D. BAUER, FILIP RONNING, JOE D. THOMPSON, Los Alamos National Lab, ROBERT J. CAVA, Department of Chemistry, Princeton University — Sizable single crystals of the superconducting iron-pnictide system (Ca $_{1-x}$ La$_x$)$_{10}$(Pt$_3$As$_8$)(Fe$_2$As$_2$)$_5$ (x=0 to 0.182) have been grown and characterized by X-ray, microscopic, resistivity, Hall coefficient, susceptibility and specific heat measurements. Features in magnetic susceptibility, specific heat and two kinks in the derivative of the electrical resistivity around 100 K in the x=0 compound support the existence of decoupled structural and magnetic phase transitions. With La doping, the structural/magnetic phase transitions are suppressed and a dome of superconductivity with a maximal T_c up to 23 K is observed in the temperature-concentration phase diagram. Soft point-contact spectroscopy was performed on the optimally doped sample of x=0.145. By fitting the multigap Blonder-Tinkham-Klapwijk(BTK) model to the data, three gaps with Δ_1 =1 meV, Δ_2 =8 meV and Δ_3 =27 meV are revealed. Acknowledgement: Work at Los Alamos was performed under the auspices of the US DOE.

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