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Intrinsic crystal phase separation and detailed structural characterization in $Cs_xFe_{2-v}Se_2$ superconductor via high resolution diffraction MIHAI STURZA, DUCK YOUNG CHUNG, HELMUT CLAUS, Argonne National Laboratory, MERCOURI KANATZIDIS, Argonne National Laboratory and Northwestern University, MATERIALS SCIENCE DIVISION-ARGONNE NATIONAL LABORATORY TEAM, DEPARTMENT OF CHEMISTRY- NORTHWESTERN UNIVERSITY COLLABORATION — The discovery of high critical temperature superconductivity in complex metal cuprate pnictide and chalcogenide compounds is a major breakthrough in materials synthesis and in developing new concepts, compounds and technologies. The mechanisms of charge carrier density control are important as small changes in composition produce metal-insulator transitions and generate superconductivity at temperatures of up to 37K in chalcogenides. Reported materials are based on a square FeSe layer built from edge-sharing of FeSe₄ tetrahedra. Insertion of alkali metal cations between FeSe layers affords superconductivity in this system. We have grown Cs-intercalated FeSe samples that show superconductivity with different Tc between 10K and 28K by changing the iron and cesium concentration in the nominal composition $Cs_xFe_{2-v}Se_2$ (0.7 < x < 1.1, 0 < y < 0.7). These are two phase systems and only one phase is SC. The relationship between structural and superconducting properties will be discussed based on highresolution X-ray diffraction and single-crystal X-ray measurements combined with magnetometry, heat capacity, and transport measurements.

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