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Pressure induced structural modifications in $NaFe_{1.99}Co_{0.01}As_2$ superconductor ELISSAIOS STAVROU, XIAO-JIA CHEN, ALEXANDER GONCHAROV, Geophysical Laboratory, Carnegie Institution of Washington, 5251 Broad Branch Road NW, Washington, DC 20015, USA, A. WANG, Y. YAN, X. LUO, X. CHEN, Hefei National Laboratory for Physical Science at Microscale, Department of Physics, University of Science and Technology, Anhui 230026, China — $NaFe_{1.99}Co_{0.01}As_2$ superconductor with the tetragonal $ThCr_2Si_2$-type structure ($I4/mmm$) has been studied using x-ray diffraction and Raman spectroscopy up to 25 GPa (at RT). Recently, it was found that, for this compound, T_c increases with pressure to a maximum of 32 K at 2.5 GPa. With further compression T_c decreases up to 6 GPa, the highest pressure superconductivity has been detected. We report that, although $NaFe_{1.99}Co_{0.01}As_2$ remains in the ambient pressure phase, the lattice parameters evolution with pressure shows distinct behavior below and above a critical pressure Pc=2.5 GPa. This is accompanied by a subtle change of Raman spectra at Pc. Below Pc, a-axis increases while both the c-axis and the c/a axial ratio decrease. In contrast above Pc, both axes show a normal decrease and c/a remains almost constant. The different behavior of c-axis, below and above Pc, can be viewed as a modification of the initial tetragonal phase (T) to a collapsed tetragonal (CT) one. This is in line with previous studies on 122 iron-based superconductors. We conclude that the high compressibility of c-axis, in the T phase, enhances superconductivity since layers are brought together. Above Pc, compression of CT phase seems to have the opposite effect.

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