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Tuning superconductivity in $BaFe_2As_2$ thin films by tetrahedral geometry design JONG-HOON KANG, Univ of Wisconsin, Madison, P. J. RYAN, Argonne National Laboratory, J. W. LEE, Univ of Wisconsin, Madison, J. W. KIM, Y. CHOI, Argonne National Laboratory, J. JIANG, E. E. HELLSTROM, D. C. LARBALESTIER, National High Magnetic Field Laboratory, C.B. EOM, Univ of Wisconsin, Madison, UNIV OF WISCONSIN, MADISON COLLABORATION, ARGONNE NATIONAL LABORATORY COLLABORATION, NATIONAL HIGH MAGNETIC FIELD LABORATORY COLLABORATION — Significant progress has been made in fabricating high-quality epitaxial thin films of iron-based superconductors. Strain engineering offers the possibility of tailoring the structural distortions at the atomic scale and enhancing superconducting properties. Here, we report that tetrahedral geometry driven by thin film strain leads to a significant enhancement of the superconducting transition temperature (T_c) of optimal Co-doped epitaxial $BaFe_2As_2$ thin films above the value of the bulk single crystals. We have found that the As-Fe-As bond angles were strongly modified by both epitaxial and thermal strains caused by the temperature-dependent lattice mismatch between $BaFe_2As_2$ thin films and the substrates. Synchrotron x-ray diffraction and resonant scattering demonstrate that the As-Fe-As bond angle and T_c are systematically tuned by in-plane strain and reach maximum T_c at the optimum bond angle of 109.5^o. Strain engineering can provide a path toward tailoring superconducting properties and understanding superconductivity in other Fe-based superconducting thin films such as monolayer FeSe.

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