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Superconductivity of Iron Selenide Thin Films¹ YUEFENG NIE, ERIND BRAHIMI, JOSEPH BUDNICK, WILLIAM HINES, MENKA JAIN, BARRETT WELLS, University of Connecticut — Near stoichiometry FeSe films were successfully grown on MgO, SrTiO₃, and LaAlO₃ single crystal substrates using pulsed laser deposition (PLD). X-ray diffraction analysis showed that the FeSe films have a tetragonal structure on SrTiO₃ and LaAlO₃ substrates. A mixture of tetragonal and hexagonal structures was observed on MgO substrates due to the larger lattice constant misfit. The superconductivity of films exhibited a strong dependence on epitaxial strain and thickness. Thicker films (~ 100 nm and ~ 200 nm) are fully relaxed and have a clear superconducting transition near that of the bulk FeSe. Thinner films (~ 50 nm) are strained. Films on nearly lattice-matched LaAlO₃ are superconducting, while films under tension on SrTiO₃ or MgO are metallic but not superconducting down to 5K. The onset temperature for superconductivity have a near linear magnetic field dependence with $dH/dT = -2.8$ T/K for fields up to 9T.

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