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Revealing the electronic structure of the iron pnictides with electron energy-loss spectroscopy J.C. IDROBO, W. ZHOU, Vanderbilt U./ORNL, M.F. CHISHOLM, ORNL, M.P. PRANGE, Vanderbilt U./ORNL, A.S. SEFAT, M.A. MCGUIRE, B.C. SALES, ORNL, S.J. PENNYCOOK, ORNL/Vanderbilt U., S.T. PANTELIDES, Vanderbilt U./ORNL — We report electron energy-loss spectroscopy (EELS) studies of the parent compounds (LnFeAsO, Ln=La, Ce, Pr, Nd, Sm, Gd) using scanning transmission electron microscopy. We find that all the studied LnFeAsO present a Fe L-edge fine structure closer to that of metallic iron than iron oxides. We observe a direct correlation between the Fe valence state (obtained from EELS) and T_C , i.e. the smaller the calculated Fe valence state, the larger is the T_C for that compound. We also find an anomalous crystallographic orientation-dependence of the Ln M_{45} edge fine structure. In particular, we find difference in the apparent crystal field splitting of Ce and Gd f- bands when the spectra are collected parallel and perpendicular to the c-axis. This research was partially supported by NSF Grant No. DMR-0938330 (JCI, WZ), by ORNL's Shared Research Equipment (SHaRE) User Facility, which is sponsored by the Office of Basic Energy Sciences, U.S. Department of Energy (JCI) and the Office of Basic Energy Sciences, Materials Sciences and Engineering Division, U.S. Department of Energy (MC, ASS, MAM, BCS & SJP), DOE grant DE- F002-09ER46554 (MP, STP), and by the McMinn Endowment (STP) at Vanderbilt University.

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