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***In situ* X-ray Synchrotron Diffraction Study of the Synthesis of LaFeAsO and LaFeAsO$_{1-x}$F$_x$** R.W. MCCALLUM, Ames Laborstory, Materials Science and Engineering, Iowa State University, Ames, IA 50011, J.-Q. YAN, G.E. RUSTAN, E.D. MUN, S. DAS, R.C. NATH, YOUWEN XU, S.L. BUD'KO, K.W. DENNIS, Ames Laaboratory, USDOE, Iowa State University, Ames, IA 50011, D.C. JOHNSTON, P.C. CANFIELD, M.J. KRAMER, A. KREYSSIG, T.A. LOGRASSO, A.I. GOLDMAN, Ames Laboratory, Department of Physics and Astronomy, Iowa State University, Ames, IA 50011 — The reaction path for the synthesis of LaFeAsO and LaFeAsO$_{1-x}$F$_x$ by nominally solid state reaction was studied by *in situ* x-ray synchrotron diffraction technique and Differential Thermal Analysis (DTA) in the temperature interval 100 $^\circ$C $\leq$ T $\leq$ 1150 $^\circ$C. Starting materials were LaAs, Fe_2O_3, Fe and for the F containing materials LaF3. The results show that the synthesis is characterized by three temperature intervals: (1) below 400 $^\circ$C, Fe_2O_3 gradually transforms to Fe_3O_4. (2) In the temperature interval 400 $^\circ$C $<$ T $<$ 800 $^\circ$C, multiple intermediate reactions take place resulting in the formation of La_2O_3 and Fe – As compounds. (3) above 800 $^\circ$C, reaction leads to the formation of LaFeAsO. Possible reaction paths and the difference between F-free and F-doped samples will be discussed in the talk.

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