EXPERIMENTAL REPLICATION OF RELICT "DUSTY" OLIVINE IN TYPE 1B CHONDRULES. G. E. Lofgren[1] and L. Le[2], [1]NASA Johnson Space Center, Houston, TX 77058, [2]Lockheed-Martin, Houston, TX 77058, gary.e.lofgren1@jsc.nasa.gov

Introduction: Relict "dusty" olivine is considered to be a remnants of previous chondrule forming events based on petrographic and chemical evidence [1]. Dynamic crystallization experiments confirm that dusty olivine can be produced by reduction of FeO-rich olivine in Unequilibrated Ordinary Chondrite (UOC) material. The results of these experiments compliment those of [2] who also produced dusty olivine, but from synthetic starting materials.

Techniques: Dynamic crystallization experiments were conducted in which UOC material was reduced in presence of graphite. Starting material was coarsely ground GRO95554 or WSG95300 that contained olivine of Fo 65-98. Approximately 75 mg. of UOC material was placed in a graphite crucible and sealed in an evacuated silica tube. The tube was suspended in a gas-mixing furnace operated at 1 log unit below the IW buffer [3]. The experiments were as brief as 1.5 hrs up to 121 hrs

Results: Dusty olivine was produced readily in experiments melted at 1400°C for 1 hr. and cooled between 5 and 100°C/hr or melted at 1300-1400°C for 24 hours. Fe-rich olivine (dusty olivine precursors) that have been partially reduced were common in the experiments melted at 1400°C and cooled at 1000°C/hr or melted at 1200°C for 24 hrs. Relict olivine is absent in experiments melted at 1400 for 24 hrs, melted above 1400°C, or cooled more slowly than 10°C/hr. Relict olivine in the experiments has minimum Fo value of 83. Thus even in the shortest experiments the most Fe-rich olivine has been altered significantly. The precursor olivine disappears in a few to many hours depending on temperature. The experiments show Fe-rich olivine in all stages of transition to the new dusty form. The olivine is reduced to form dusty olivine in a matter of a few hours at temperatures less than 1400°C and in minutes at higher temperatures. The reduction appears to proceed from the rim of the crystal inward with time. The reduction appears initially rectilinear as if controlled by crystallography, but with time Fe-metal blebs are randomly distributed throughout the olivine. In a given experiment, dusty olivine can be found in varying stages of development, but in the longest experiments, the Fe-metal blebs are dominant and they appear to be migrating out of the olivine. The composition of the dusty olivine ranges from Fo 94-99. The Cr, Mn, and Ca content of the newly formed, dusty olivine is slightly less on average that the precursor olivine, but is till with the range of type 1 olivine. Chadacrysts in the low Ca pyroxene are most common in the higher temperature, more slowly cooled experiments and range in composition from Fo 90-99.

Application to chondrule formation: These experiments place time-temperature limits on the preservation of Fe-rich olivine and the production of dusty olivine during chondrule forming events. The reduction process proceeds in a few hours at temperatures above 1400°C and in 10's of hours at temperatures between 1200 and 1300°C. This result further confirms that chondrules form in a few hours to days as suggested earlier by [4]. The experiments also confirm that dusty olivine can form from typical Fe-rich olivine in UOC material during the recycling of such olivine in the chondrule forming process.

References: [1] Jones R. H. and Danielson L. R. (1997) *Meteorit. Planet. Sci., 32,* 753-760. [2] Connolly H. C. Jr. et al. (1994) *Nature, 371,* 136-139. [3] Lofgren G. E. and Le L. (2002) *LPS XXXIII*, abs. #1746. [4] Lofgren G. E. (1996) *Chondrules and the Protoplanetary Disk*, R.H. Hewins, R.H. Jones, E.R.D. Scott eds. 187-196.