THERMAL HISTORIES OF BARRED CHONDRULES FROM MELTS GENERATED EXPERIMENTALLY. P. Hernández-Reséndiz[1], K. Cervantes-de la Cruz[2] and A. Segura[1], A. U'Ren[1], H. Cruz-Ramirez[1]. [1]Instituto de Ciencias Nucleares, Universidad Nacional Autónoma de México, Circuito Exterior C.U. A. Postal 70.543 04510 México D. F., patricia.hernandez@correo.nucleares.unam.mx, [2]Facultad de Ciencias C.U., UNAM, karina-cervantes@ciencias.unam.mx

Introduction: Meteorites are samples of early processes in the protoplanetary disk where the Solar System was formed, in particular chondrites preserve the oldest components of the Solar System. Chondrules are the main component of chondrites and they are among the most primitive materials in the Solar System: 4567-4565 Myr [1], their formation coincide with the planets accretion. They are compoused of olivine $(Mg,Fe)_2SiO_4$ and poor Ca pyroxene $(Mg,Fe)SiO_3$. They were formed at temperatures in the range of 1300-1800 °C in the course of seconds and at most several minutes [2,3]. The important unknowns in the formation of chondrules are:

- The starting composition of the precursors.
- The physical conditions of their formation (pressure, temperature and time).
- The mechanisms that produce them.

The main aspects of chondrules are:

1. The retention of volatile materials such as S, Na and K, wich had not survived heating and/or cooling for long periods of time.
2. The existence of grains and edges indicating different heating pulses, instead of monotonic cooling after a single heating.

Barred chondrules represent the 10% of all chondrules in ordinary chondrites [4]. They determine an upper limit in temperature for chondrule formation conditions because their characteristic texture is only formed at higest temperatures (with respect to other textures). It is not known what is the precise mechanism of heating of chondrule precursors. The most accepted model is "flash heating", originated by shockwave fronts propagating through the interior of the solar nebula [5].

The thermal histories provide the most important information in the chondrule formation, therefore the constrains on thermal histories are keys to find the processes that originated chondrules [6]. The formation models of chondrules propose thermal histories of chondrules which do not agree sufficiently well with those found experimentally.

Objectives: There are two main objectives:

- To determine what kind of heating conditions reproduce the features observed in chondrules located in chondrites.
- To associate the experimental thermal histories with those proposed by chondrule formation models, in order to constrain the conditions of the disk that gave rise to the Solar System.

Methodology: We simulate the formation of barred olivine chondrules by melting olivine crystals using a 50 W CO_2 laser emitting in the infrared at a wavelength of 10.6 μm. We measure the temperature during and after the melting, therefore each melt has one thermal history recorded. Subsequently, we perform petrological, chemical, crystallographic and textural analysis of the melts. These set of analysis will be compared with the natural chondrules. The thermal histories of those experimental melts that reproduce the characteristics of natural chondrules will be used to constrain the scenarios of chondrule formation and the physical conditions of the solar nebula.

Preliminary results: During the experimental formation, the maximum temperature range was 800 to 1800 ºC. The cristallization time was in a few cents of second. The bars width range is 9-16 μm; compared with natural chondrules, the bars width is similar to measurements in barred chondrules of some ordinary chondrites [7]. The diameter of experimental melts is similar to the natural chondrules [8], the range was 500-1000 μm (see figure 1).

Acknowledgements: PAPIIT Projects No. IA101312 and No. IA105515, CONACYT Project No. 128228, CONACYT PhD scholarship.

References: [1] Connelly et al. (2012) *Science 338*, 651–655. [2] Lofgten (1996*) Int. Conf. Chondrules & the Protoplanetary Disk*, 187-196. [3] Scott (2007) *Annu. Rev. Earth Planet. Sci. 35:* 577–620 [4] Gooding & Keil (1981) *Meteoritics, v. 16*, 17–43. [5] Hewins et al. (1996) *Int. Conf. Chondrules & the Protoplanetary Disk*. [6] Desch et al. (2012) *Meteoritics & Planetary Science 47*, Nr 7, 1139–1156. [7] Cervantes de la Cruz et al. (2015) *78th Annual Meeting of the Meteoritical Society*, Abstract #5380. [8] Cervantes de la Cruz et al. (2006) *LPSC XXXVII*, Abstract #1198.

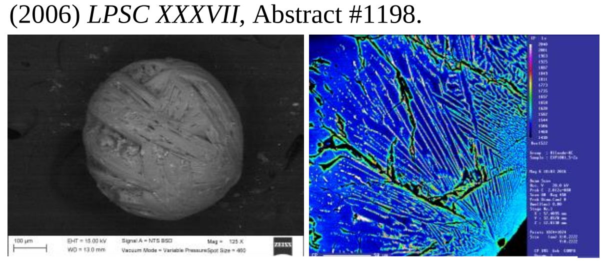

Figure 1. Sample EX18_1-5, one of the melts obtained.