

## **THE INFLUENCE OF GRAVITATIONAL BODY FORCE IN METEORITIC CHONDRULE AND LUNAR GLASS FORMATION**

**P.Z. Budka**, *Dept. of Mechanical Engineering, Union College, Schenectady, NY 12308*

The effects of gravitational body force must be considered in the formation of extraterrestrial materials such as meteoritic chondrules and lunar glasses. Solidification experiments conducted in microgravity as well as at  $g$  values greater than Earth's gravitational force have demonstrated that gravitational force can have profound and sometimes unexpected effects upon the way materials solidify and, therefore, upon their physical and mechanical properties. Solutal, thermal and sedimentation effects differ from those experienced on Earth. Because buoyancy forces are reduced, materials of different densities may remain in close proximity.

The spherical morphology of chondrules and many lunar glasses may reflect the tendency for free-floating liquids to form spherical droplets in a microgravity environment, a form which minimizes surface energy. Under these conditions, surface energy forces dominate gravity forces. The formation of two common chondrule textures, barred and radiating chondrules, can be explained using observations from glass science. Similar textures occur in silicate melts. For example, barium disilicate spherulites (similar to radiating chondrules) may break up into a lathlike (barred) structure upon aging. Nucleating agents, such as  $P_2O_5$ , present during chondrule formation, may determine whether local solidification occurs as glass, crystal, or a mixture of the two.

The inhomogeneity of lunar glasses can be compared with the lack of mixing observed during Skylab fluid mechanics experiments. In microgravity, droplets of different compositions may meet and coalesce, but mixing does not occur immediately. Many lunar glasses solidified before diffusion could homogenize the composition.

The Materials Processing in Space Program has demonstrated that gravitational force can have a significant and complex influence on solidification. Given the wide variety of cosmic bodies and the complexity of cosmic processes still being discovered, there is no reason to assume that extraterrestrial materials have experienced the same gravitational force that exists on Earth.

**Meteoritics: The Journal of the Meteoritical Society**  
**Vol. 19, No. 4 1984 Page 201**