APPEARANCE OF THE IMPACT FLASH IN METEORITE DISRUPTION EXPERIMENTS.

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Introduction: Studies of the optical flash that occurs in a hypervelocity impact have been done for some time [1, 2, 3], however, most of these have concentrated on results applying to space debris or missile defense. Our lab has observed the flash and occasionally made casual observations, but have done no concentrated studies on this flash. Herein we report on a preliminary examination of the flash as impacts are made into a variety of geological materials.

Experimental Setup: Terrestrial and meteoritic materials have been impacted for a number of years using the NASA Ames Vertical Gun Range. We have reported on other aspects of these experiments, including the energy of impact [4] and the -requency distribution of the ejecta [5]. The impacts have been imaged using high speed photography. Using this imagery we have made observations on a range of materials under a variety of impact conditions. The samples are hung from a nylon line in a near vacuum and then impacted with 1/16" or 1/8" Al- projectiles moving between 4 and 5.5 km/sec. Although various angles were imaged, a consistent view from above was used to study the impact flash. Imagery was done at a frame rate of ~70,000 fps. To characterize the flash, observations were done on color, shape and duration of the flash, and the size of the flash relative to the size of the sample.

Results and Discussion: A combination of terrestrial hydrated samples and various classes of meteorites, including artificially hydrated CI simulant materials, were measured. In general, it was observed that the initial flash for hydrated materials was smaller and more confined in shape, and that the entire flash sequence was shorter than for nonhydrated materials. Smaller flashes tended to be shaded with yellow or pink, while bigger flashes were haloed with blue. There did not seem to be a correlation with impactor size or speed, or whether the resulting impact resulted in disruption of the sample or not. There is a concern about the timing of the flash with the video timing. This is more of a concern in earlier years when the frame rate was lower. The results were relatively consistent across multiple impacts on different samples of the same material.

Table I. Summary of Observations on Impact Flash

Sample	Impact Speed (km/sec)	Impactor Size (inch)	Flash to Sample Size Ratio	Flash Shape	Flash Color
Carbonate	4.56	1/16	0.35	Ball with flare	White/pink
Montmorillonite	4.57	1/16	0.03	Small ball	White/yellow
Serpentine	4.21	1/16	0.23	Small jet	Pink/white
Hydrated NWA 4502	4.93	1/16	0.19	Flare	White
Hydrated NWA 869	5.08	1/16	0.25	Ball	Yellow/white
NWA 4502	4.5	1/16	2.14	Ball with flare	Blue/white
NWA 869	4.31	1/16	0.11	Flare	Blue/white
Saratov	4.18	1/16	1.66	Flare	Blue/white
Gibeon	4.47	1/16	5.23	Flash	Blue/white

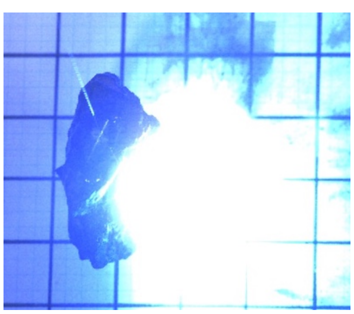

Figure 1. Initial impact for NWA 4502 (CV3) showing large blue-white flash. The grid in the background is a 1-inch grid used for impact recoil measurements.

Figure 2. Initial impact for a sample of montmorillonite against the same background as in Figure 1.

References: [1] Eichorn, G. (1975) *Planet. Space Sci.* 23:1519-1525. [2] Lawrence, R.J. et al. (2006) *Intl. J. Imp. Engr.* 33:353-363. [3] Goel, A. et al. (2015) *Intl. J. Imp. Engr.* 84:54-63. [4] Flynn, G.J. et al. (2017) *Planet. Space Sci.* 164:91-105. [5] Flynn, G.J. et al. (2009) *Planet. Space Sci.* 57:119-126.