44th LPSC
Lunar and Planetary Science Conference
March 18–22, 2013
The Woodlands, Texas

EXTRACTION OF METEORITIC METALS FROM LUNAR REGOLITH

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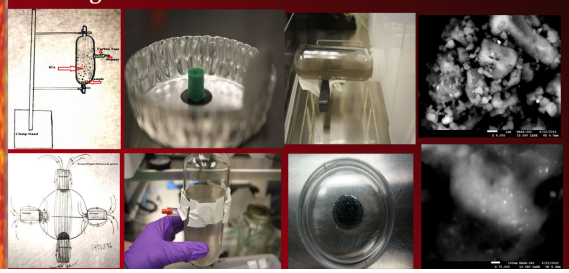
Introduction: We have begun a series of new experiments, the aim of which is to develop methods of magnetically separating meteoritic metals from lunar soil. To our knowledge, no other attempts have been made to accomplish this. The task is daunting because meteoritic metals are not the only magnetically-susceptible materials in lunar soil. It is known [1] that pure metallic iron exists in the soil in the form of nanophase iron globules (npFe0) in the rims of soil grains, and that lunar soil as a whole seems to be magnetically susceptible [2]. Moreover, while the amount of pure meteoritic metal increases with decreasing grainsize, the amount ofnpFe0 also increases with decreasing grainsize[3-5].

Experimental Set-up: Our experiments involved placing magnets of various strengths at varying distances from a lunar soil sample which was immersed in isopropanol (IPA). In most tests, magnets were arranged in a horizontal plane at the height of the side arm of a modified Dean-Stark apparatus, which was filled with isopropanol to a level slightly higher than the magnets. The stopper of the side-arm held a piece of carbon tape. The configurations were maintained for 30 minutes to an hour, after which the carbon tape was removed and prepared for Scanning Electron Microscope (SEM) examination. Four different magnet configurations were used.SEM studies were performed and the amounts of meteoritic metal and npFeo-rich grains were determined by grain counting.



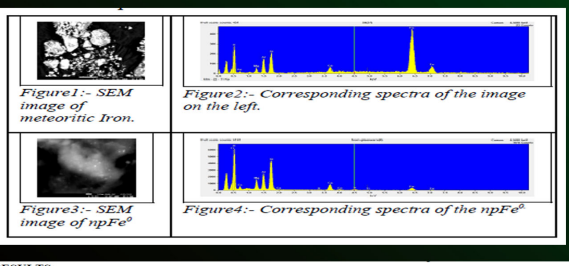


Figure1:- SEM image of meteoritic Iron.

Figure2:- Corresponding spectra of the image on the left.

Figure3:- SEM image of npFe⁰

Figure4:- Corresponding spectra of the npFe⁰

RESULTS:

Magnet Configurations	Samples	Run #	Meteoritic Metal Grains	# of Grains with npFe⁰
Test 1:- Twomagnets immersed in IPA with sample	Size-fractionated dust (median diameter 3.0 micrometers) from lunar soil 14003, 96.	Strong magnet	50	251
		Weak magnet	16	88
Test 2:- One magnet outside the glassware	Size-fractionated dust (median diameter 3.0 micrometers) from lunar soil 14003, 96.	1	4	14
		2	7	6
Test 3:- One magnet at 3.5 cm from glassware	Size-fractionated dust (median diameter 3.0 micrometers) from lunar soil 14003, 96.	1	7	6
Test 4:-Four magnets (two stronger,two weaker)	Size-fractionated dust (median diameter 3.0 micrometers) from lunar soil 14003, 96.	1	0	0
		2	0	0
	Material ground to a median size of 2.2 micrometers from lunar soil 14003,96	1	155	22
		2	0	0
		3	11	14
		4	0	0
	Size-fractionated dust (median diameter 1.5 micrometers) from lunar soil 14003, 96.	1	61	9
		2	2	2
		3	4	2
		4	5	4
	Bulk sample 12003,182 (median diameter 16.5 micrometers).	1	9	2
		2	n.d.	n.d.
		3	11	8

Conclusion: -

Experimental results indicate promise for the extraction of meteoritic metals from lunar regolith. However, more work is needed to refine the technique and understand more about the variables that affected our results.

References:

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