A Review on the Comparison of Volatile Evolution from a Lunar Simulant, conducted at KIGAM. K.J. Kim[1],
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Abstract: Volatile extraction on the Moon is an important task for the future of in-situ resource utilization, regardless of the location on the Moon. Many experiments have been carried out on the Apollo return samples in a laboratory environment. Currently, the data obtained from the Apollo samples are invaluable when referenced for the development of an ISRU payload designed to extract volatiles on the Moon as part of lunar surface exploration.

In addition to extracting volatiles from the regolith, it is important to investigate oxygen production on the Moon. Oxygen is present as a volatile on the lunar surface, but the amount available is limited for human use. The best option is to produce oxygen from the lunar regolith. The abundance of oxygen on the Moon is approximately 45 wt%. Oxygen can be produced anywhere on the lunar surface, and a widely known extraction method is Molten Regolith Electrolysis (MRE), which requires a heating temperature of approximately 2000°C. At a low heating temperature of 700°C with an IR lamp, volatiles present in lunar samples can be extracted (see Figure 1 and Figure 2). However, breaking down minerals to obtain evolved gases requires higher temperatures.

Recently, a new method has been applied to extract volatiles and produce oxygen from lunar simulant samples. Our preliminary results show a positive outcome in producing oxygen using this method. A hundred times the background level of oxygen was evolved when the heating temperature reached over 1100°C with this system (see Figure 3). This preliminary study confirms the effectiveness of the method for volatile extraction and oxygen production from lunar simulant using an electron beam source.

A few years ago, we also investigated volatile extraction at a heating temperature of 700°C. Most residual volatiles in the lunar simulant were found to be released at this temperature. This presentation will demonstrate a comparison of gas evolution phenomena between the two methods, as well as a new research direction for oxygen extraction using an e-beam gun.

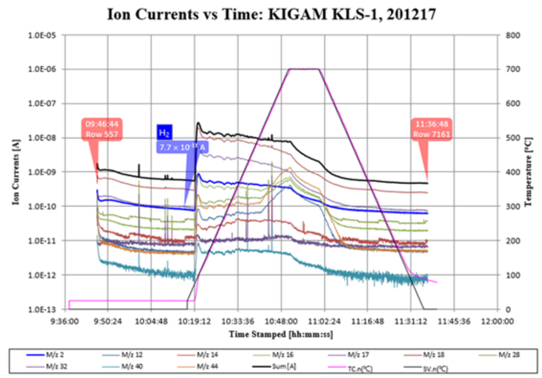

Figure 1. Ion current of gas release as a function of time and temperatuare.

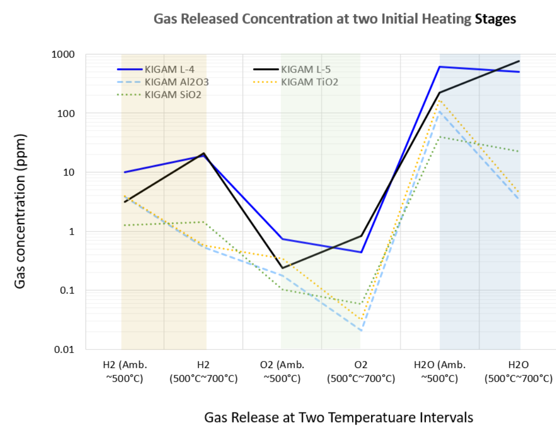

Figure 2. Gas released during two initial heating stages.

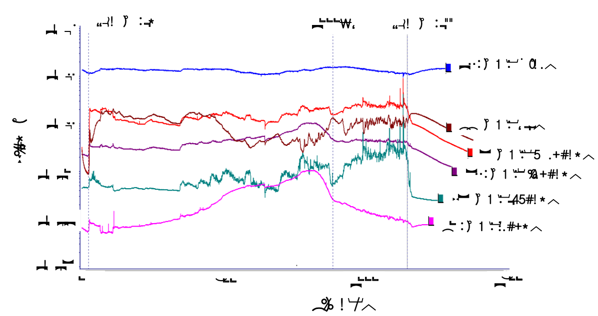

Figure 3. Gas evolved as a function of time using an e-beam gun

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