# Experimental Study on Li fire with the heat insulator employed in the liquid Li target loop of a fusion neutron source

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For the safety design of the liquid Li target in a fusion neutron source (FNS) based on the D-Li stripping reaction, experimental studies on Li fire have been performed with the insulator that were employed in the IFMIF/EVEDA Lithium Test Loop (ELTL). The results indicate the insulator has no characteristics encouraging Li fire ignition under the same humidity conditions that are being considered in the A-FNS.

**Keywords:** A-FNS, fusion neutron source, liquid metal, liquid lithium loop, Li fire

## 1. Introduction

In the FNS, liquid Li is applied as target material. For the safety operation of the Li target, Li fire risk reduction is indispensable. One of the conditions affecting the Li fire ignition is humidity [1]. Therefore, the humidity at which Li fire ignites was investigated. In addition, the leaked Li from a loop contact with an insulator. Thus, a heat insulator has to have no characteristics encouraging Li fire ignition. In order to evaluate the compatibility with Li and the insulator, an experimental study on Li fire ignition was performed. These experiments are included in the IFMIF/EVEDA project [2,3].

## 2. Method

Li samples were installed in a chamber connected with a dry air tank. The humidity in the chamber was changed by controlling the amount of the air flowing through a water bubbler. Li metal samples were heated until 600 °C under different humidities (less than 0.001, 0.15, 0.3, 0.6, and 3 vol.%). Heating experiments with insulators were performed under the humidity at which no ignition was seen in the experiments without insulator. The insulator was a refractory ceramic fiber mainly made of $Al_2O_3$ and $SiO_2$ that was employed in ELTL. In order to acquire repeatability data, the experiments were repeated three times under the same conditions.

Table. 1 The results of Li fire experiments under the different atmosphere without insulators.

| Atmosphere | Result |
|---|---|
| Dry Air (humidity **less than 0.001** vol.%) | No ignition |
| Wet Air (humidity **0.15** vol.%) | No ignition |
| Wet Air (humidity **0.3** vol.%) | Mild ignition was seen once in 3 experiments. |
| Wet Air (humidity **0.6** vol.%) | Vigorous ignition |
| Wet Air (humidity **3** vol.%) | Vigorous ignition |

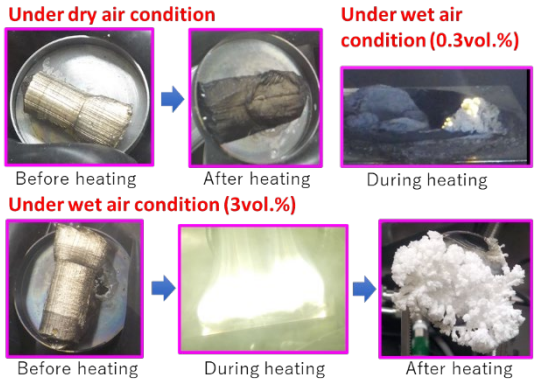


Fig. 1 The images of the heating experiments under different conditions without insulators.

## 3. Result

The results of heating experiments without insulators under different humidity conditions are summarized in Table 1. The experimental images are shown in Fig.1. The ignition under the humidity condition of 0.3 vol.% was much milder than that of more than 0.6 vol.%, which was caused by lower humidity. Under the humidity condition of 0.15 vol.%, ignition was not seen. This humidity is expected to be easily reached with normal compressors and reasonable as the humidity of the Li loop cell in A-FNS. The heating experiments with insulators were conducted under the humidity condition of 0.15 vol.% humidity. No Li ignition was also confirmed in the experiments. From the results, it is concluded the insulator has no characteristics encouraging Li fire ignition under the same conditions that are being considered in the A-FNS Li loop cell.

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