

**Advanced Materials Testing for
Lunar Landing & Launch Pad Construction**

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ABSTRACT

Five candidate lunar landing and launch pad candidate materials were evaluated in relevant Oxygen/Methane rocket engine plume environment exposure tests. The performance trends were modeled, observed, measured (to the extent possible), and testing results were evaluated. A total of fifteen high temperature plume tests were performed in two test campaigns: five in December 2020 and ten in March 2021. The results indicate that several of the selected materials are promising for future consideration in designing and building lunar landing and launch pads, although further development work is needed for all of them.

The project team reviewed and evaluated a wide range of materials and associated construction techniques for lunar landing and launch pads (LLP) during a trade study to determine their level of readiness and suitability to perform the functions of a LLP. The scope and number of engine tests was constrained by the project budget and limited the number of candidate materials to be tested. The selection of materials to be tested was guided by the following criteria:

- The minimum TRL of the candidate material should be 3-4
- Near term availability of the components to make the candidate material
- The feasibility of completing a design, manufacturing the material, and assembling by the test date

The most promising materials tested were:

- thermally sintered, grouted basalt regolith pavers;
- ablative materials made of thermoset polymer mixed with basalt regolith;
- anorthosite rocks packaged in Gabion cages.

Textile blankets consisting of layers of woven and non-woven carbon fiber layers survived the tests but showed some damage and wear.

Carbon fiber textile bags filled with regolith did not survive the tests but could be developed with lessons learned applied.

Test results and lessons learned will be documented and presented.