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CHEMCAM PASSES FINAL ROVER TESTS

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Over the last ten weeks ChemCam participated in the final three Curiosity environmental tests and came through with flying colors. These major tests included vibration, thermal, and EMI/EMC, and are required of all spacecraft prior to launch. The first two, affectionately known as "shake 'n bake" test the spacecraft's ability to survive the vibrational environments associated with launch, re-entry, and landing, and test the rover under realistic temperature conditions expected on Mars. In this case "bake" is a misnomer, as Mars is generally a cold planet. The test took the rover all the way down to about -120°C (-185°F), which is the coldest expected on Mars. In between the two tests Curiosity tested its explosive bolts that are fired to deploy the mast, as will be done as soon as the rover lands on Mars.

The last of the three tests checked various parts of the rover for electromagnetic interference and electromagnetic compatibility. Some electronics components create radio noise that can interfere with other instruments or parts of the rover, and these tests checked to make sure that all of the parts of the Curiosity could work together without interfering with each other.

ChemCam was subjected to each of these tests before as a stand-alone instrument, but this was the first time for these environments as part of the rover. For vibration ChemCam needed only to survive the test, as the instrument is not powered on during launch or landing. For the other two tests ChemCam was powered on and took images and shot at targets. One image shows a one inch (2.5 cm) square metal plate mounted on the back of the rover which ChemCam uses for calibration. A laser pit can easily be seen in the center. The image was taken by Chemcam's remote micro-imager.

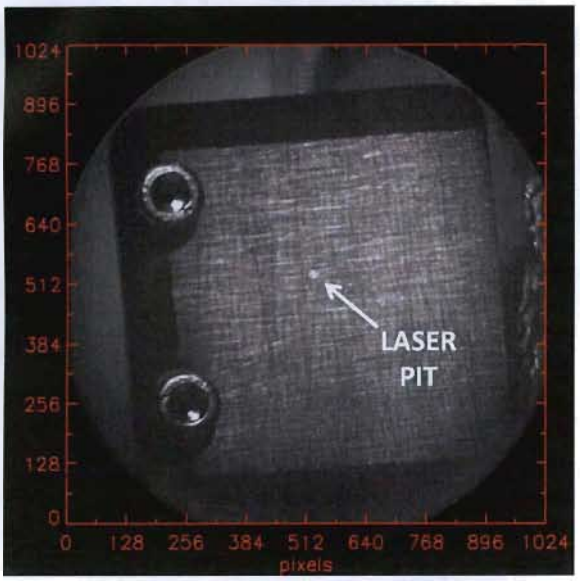
The ChemCam team prepared panels of rock slabs provided by Dick Morris for the rover to practice shooting at during the thermal test, which lasted almost three weeks. Most of the rock samples were homogeneous basalts so the team could check out its procedures for determining the composition.

The most interesting sample was a slab of banded iron formation. This material comes uniquely from an early period in Earth's history 2.5-1.8 million years ago when there was relatively little oxygen in the atmosphere. At that time seawater was rich in iron. As bacteria began to produce oxygen resulting the iron oxides, magnetite and hematite, precipitated from the water and were laid in layers of rock, interspersed with iron-poor rock materials such as chert (SiO_2), shale, and carbonates.

The banded iron formation highlighted ChemCam's ability to probe fine rock layers. The mast can position ChemCam's analysis spots just a few millimeters apart. The spectra shown here are from two adjacent spots on the banded iron slab. The top panel shows a very large number of iron emission lines from an iron-rich rock layer, while the bottom panel shows a single, high intensity emission line of silicon, indicating the presence of chert.

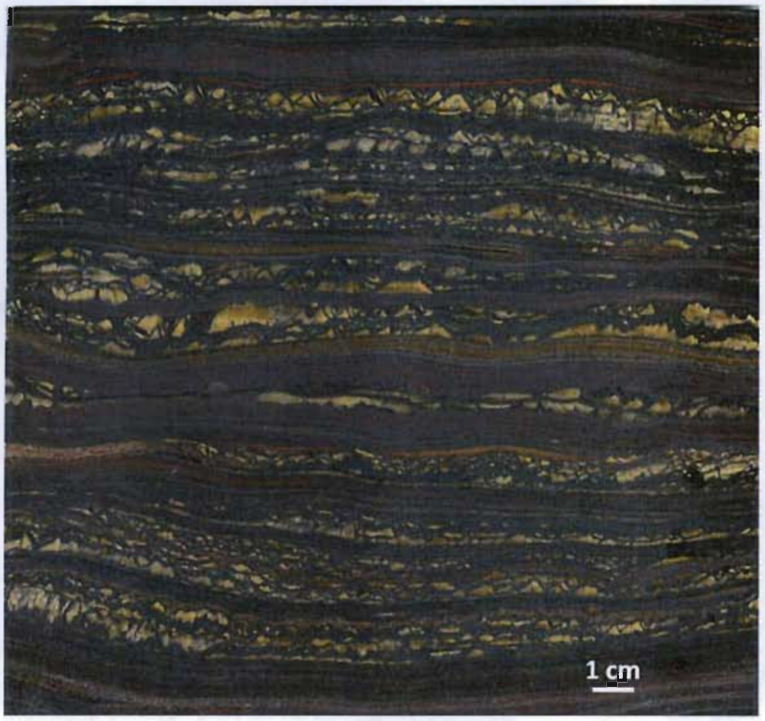
Overall, ChemCam performed flawlessly during all of the testing. During the thermal test one command was sent up with a wrong parameter. The results came back looking very strange and had the team scratching their heads for a while until the parameter error was noticed. With that problem solved it appears that ChemCam gets an A+ for the tests. With these tests completed, the rover will soon be headed for Cape Canaveral in Florida.

The Curiosity rover being prepared for the thermal environment test in March, 2011. Photo credit: JPL

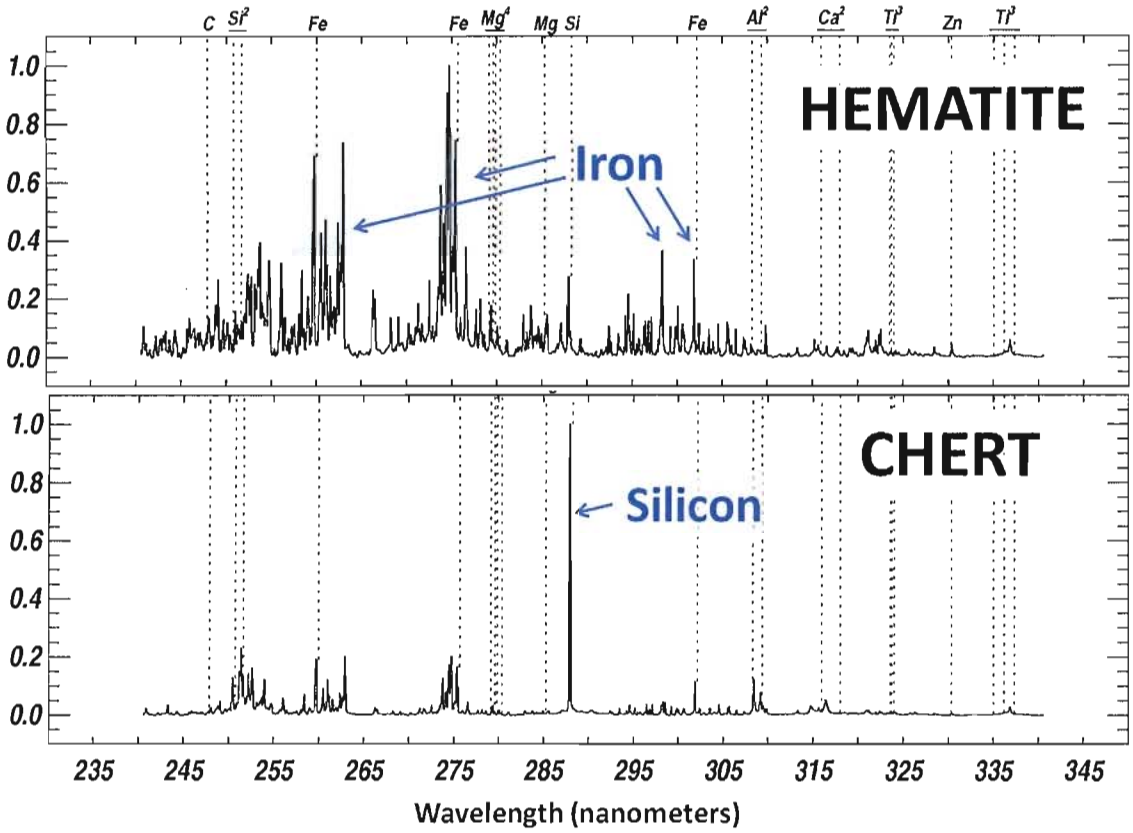


A one-inch (2.5 cm) square metal calibration target on the back of the rover showing a bright-colored laser pit. Photo credit ChemCam/LANL/IRAP.

Rock slab targets for ChemCam arranged on a metal plate. This plate was positioned ~5 m (15 ft) from the rover during thermal testing. The panel measured about 2 feet (60 cm) square. Photo credit: JPL.



Slab of banded iron formation used as a ChemCam target during rover thermal testing. The dark layers are iron rich, while the light colors are high in silicon (see spectrum below). Photo credit: JSC.



Two adjacent analysis spots on the banded iron formation sample. One spot is extremely iron rich, indicated by the huge number of iron emission lines. The lower panel shows chert, which is silicon oxide, evinced by the very tall silicon emission line. Credit ChemCam/LANL/IRAP.