



Engineering Sciences Section – 2010

C39 Solar Heat Buildup in a Parked Automobile

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After attending this presentation, attendees will understand how temperature rises inside an automobile parked in the sun.

This presentation will impact the forensic science community by providing data on temperature inside a parked vehicle. This information is related to hyperthermia and material properties.

The temperature inside a parked vehicle can rise dramatically, when parked in the direct sun. This can play a role on both the comfort and safety of occupants. Children, elderly, those taking certain medications and pets are particularly vulnerable to heat related sickness or even death. Hyperthermia or increased core body temperature leads to heat stroke. In humans, it is life-threatening when the core body temperature rises above 40°C (104°F) and brain death begins above 41°C (106°F).

The elevated temperature can also affect the material properties of components in the vehicle. In particular, the strength properties of plastic materials are temperature dependent. This is true of structures like the plastic layer sandwiched between the glass layers in laminated safety glass. To be valid, demonstrations, including rollover testing to evaluate the performance of laminated safety glass must take this temperature into account.

A vehicle was tested in Arizona, in direct sun, when the ambient temperature was a peak of 93°F. The vehicle was facing northwest on a Portland cement pad. The testing was conducted within five miles of the National Weather Station at Sky Harbor International airport. Hourly official temperatures were compared with measured ambient temperatures.

Measurements were taken for approximately four hours starting at 10:45 a.m. on May 22, 2007. Measurements were taken on the surface of the windows, interior of the vehicle and externally.

The temperature sensors consisted of six National Semiconductor Corporation's LM35 Precision Centigrade Temperature Sensors. A handheld Cen-Tech Non-Contact Thermometer (model 91778) was used to take temperature measurements on the exterior of the windows. The six sensors were located in the following locations:

1. Interior to the vehicle, on the driver's side, 10 inches from the interior roof and centered on the visor;
2. Same as 1 except on the passenger side;
3. Between the glass and gasket on the upper rear corner of the driver's door window;
4. Same as 3 except on the passenger side front door;
5. On a tripod near the vehicle in the direct sun;
6. Attached to the front bumper. Initially in the shade and was moved at 2:00 because it was no longer in shade of vehicle;

The temperature from these sensors was measured continuously in one hour blocks. The surface temperature of the gasket around the driver's door window and passenger's door window was measured every fifteen minutes at the center top, center rear and center bottom with the hand held sensor.

The interior air temperature started out 100°F and reached 130°F after the first hour. The temperature continuously climbed till it reached a temperature in the 140 to 145°F range.

The temperature between the glass and gasket for the sunny side reached a maximum of approximately 165°F.

The hand held sensor roughly followed the measurements made by the sensors between the glass and gasket.

The high temperature of 93°F was reported at the airport at 2:00 p.m. The temperature at 1:00 and 3:00 was 88 and 90 deg. F.

In summary, on a day that the ambient temperature is 93°F., the interior air temperature will reach over 140°F, which poses a serious health risk for any occupants and the glass temperature can reach 165°F which can have an adverse affect on the material properties of laminated safety glass.

Car Temperature, Car Heat Soak, Solar Car Heating