Automotive

# Visibility of Heat Distribution on **Battery Cell Surface**

1) Measure the Heat Generation without damage to the Battery Cell 2 See the Heat Distribution inside the Batter Cell

#### Measurement Method

Goal

First, while paying attention to the fact that there is a correlation between the heat generation inside the battery cell (Q1) and the heat radiation to the outside (Q2), the correlation between the electrical and the thermal measurements was confirmed.

While the electrical measurement ca be presented by this equation <Q 1 = I  $\cdot \Delta V = I 2 \cdot R$ , the thermal one was measured as the heat dissipation to the outside by a heat flux sensor. In the thermal measurement, heat dissipation from the inside of the battery cell to the outside was measured with a heat flux sensor. Concerning the heat generation distribution of the battery cell, six heat flux sensors were attached to the surface of the battery cell, each measuring the amount of heat radiation from the inside of the battery. When comparing each of the outputs, the heat distribution can be seen.



Battery Equivalent Circuit Model



### Heat Flux Sensor [Energy Eye]



#### Results

The electrical and thermal measurements are consistent with the results in Fig. 1 and it can be said that there is a visible correlation. Therefore, it was found that the internal heat generation (I  $2 \cdot R$ ) can be measured thermally.

The heat generation distribution is shown on Fig. 2. Among the six positions measured, while seeing that the heat generation values of sensor 3 and sensor 4 are large, we are able to see the heat generation as a distribution. The highly sensitive heat flux sensor

was able to measure the small heat dissipation differences and therefore thanks to that, it was possible to see such a small heat distribution

Fig. 2 Thermal Measurement Results (Heat Distribution)



#### Considerations

Heat Generation Amount [W]

0

From this result, by knowing the small heat generation distribution inside the battery cell and grasping its state, we can use it for deterioration and lifespan diagnosis. Moreover, it can also be used as a tool to improve the accuracy of design and simulation.

## DENSO CORPORATION

1-1, Showa-cho, Kariya, Aichi 448-8661, Japan Sensor & Semiconductor Business Unit Sensor Business Development



For more details please check our website ▶▶▶ https://energyeye.com/en

