Correlation between Differential Scanning Calorimetry and Accelerating Rate Calorimetry of Lithium Ion Battery for EVs

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Lithium-ion batteries are one of the main products supporting the ubiquitous society. Applications are now extended to electric vehicles and energy storage systems. As the energy density of lithium-ion batteries increases, concerns about safety in the field are also increasing. In this study, we predicted the ARC behavior of Li-ion batteries from DSC data. Figure 1 shows the DSC of the simple sum and component mixture and the ARC data of the component mixture. Simple summing has its own exothermic peak, but the ingredient mixture is combined into one. This is due to the self-accelerating effect of components such as cathodes, anodes, separators and solvent electrolytes, which is the sum of the exothermic peaks of each component in the case of component mixing. After measuring the DSC according to the change of the scanning speed, the heat flow change of the component mixture can be compared with the heating rate of the ARC using the heat capacity shown in Table 1. The correlation of heat flow between DSC and ARC is in good agreement. This approach can be applied to predict the thermal behavior of a lithium ion battery for EV.

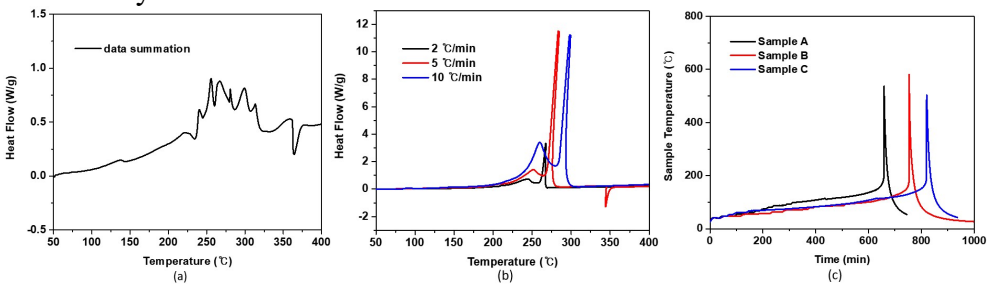

Figure 1 DSC of simple sum (a) and component mixture (b) and ARC (c)

Table 1 Correlation between DSC and ARC

Measurement	DSC	ARC	
Heat flow change	$\left[\Delta\left(\frac{dQ}{dt}\right)/\Delta T\right]_{DSC}$	$\left[\Delta(dT/dt)/\Delta T\right]_{ARC}$	$\left[\Delta(C_p \cdot dT/dt)/\Delta T\right]_{ARC,calculated}$
	0.0923	0.0729	0.0948

References:
[1] Maleki, H., Thermal Properties of Lithium-Ion Battery and Components. J. Electrochem. Soc. 146 (3) (1999), 947-954.

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