DC Resistivity Measurements of Dielectric Liquids used in Immersion Cooling of EV Batteries

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Electric vehicles (EVs) are becoming increasingly important as countries and companies alike are pushing their Net Zero targets. This is leading to a greater focus on innovation in the industry and in particular the cooling system. The performance of the cooling system is integral to that of the vehicle and one of the primary systems requiring cooling is the battery array. Keeping batteries in their ideal temperature range can decrease the rate at which they lose capacity [1] and so this is a key issue for longevity.

Cooling can be done in various ways, such as immersion cooling. Immersion cooling is new to the vehicle industry, however it is already widely implemented in high voltage power equipment, and involves placing active components directly into a liquid. Therefore, a dielectric liquid is required and these liquids can then be split into two categories, single-phase and two-phase. In EVs single-phase is the dominant choice due to its relative simplicity, and therefore lower cost, whilst outperforming air cooling [2].

Currently, the published literature on immersion cooling focuses mostly on the thermal aspect, hence why more work on electrical characterisation is needed. DC resistivity is one of the primary dielectric parameters of insulating liquids. Factors such as temperature, moisture and electrode material have been shown to affect the resistivity of dielectric liquids in other contexts, such as transformers [3]. This experiment will investigate how temperature affects the resistivity of the liquid and then future work will look into how different characteristics change with moisture and particle contamination.

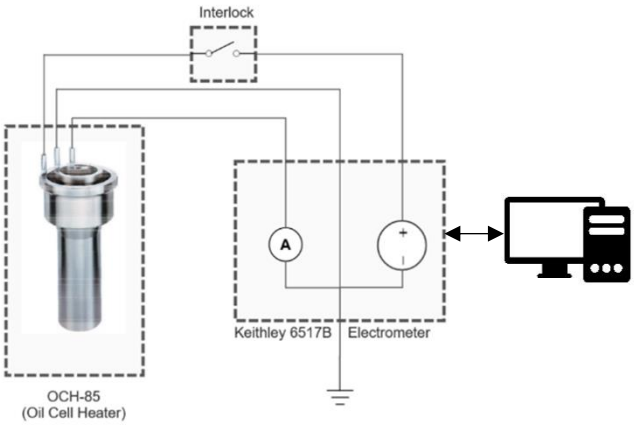

Figure 1: Experimental setup of DC resistivity calculations via current measurements.

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