

## Final Report for Granted Research nr 21-26

Project title: *Rechargeable Aqueous Al-ion Battery Using Water-in-Salt Electrolyte*

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**Summary:** Aluminium (Al) is considered as an anode material for next generation batteries. In this work, the focus was given on parameters optimization of aluminum/water in salt/nanographite cell. The parameters such as interelectrode distance, voltage range and current densities have been investigated. The aluminium/water-in-salt electrolyte/ Graphite cells were assembled in a polymeric coin-cells, which was constructed during this project. The coin-cells are designed in different thicknesses of 1, 3, 6 and 10 mm. It means that by increasing the interelectrode distance from 1 to 10 mm, the volume of water-in-salt electrolyte would also increase. The capacities for all investigated cell with different thickness showed a decrease along cycling performance. However, cell with 6 mm thickness, significantly showed a lower degradation. In addition, the Al/WIS/NG coin-cell was investigated in different voltage ranges of 0.1 up to 2.5 V at a current density of 0.5  $\text{Ag}^{-1}$ . The cycling performance showed higher capacity and stability in the voltage range of 0.1-1.6 V. Furthermore, the measurements were done on the cell at the optimum voltage range of 0.1-1.6 V and for different current densities of 0.25, 0.5, 0.6 and 0.8  $\text{Ag}^{-1}$ . It was found that the cell has shown the best cycling performance within 59 h at current density of 0.5  $\text{Ag}^{-1}$ , among other investigated current densities. SEM analyses of Al electrodes have revealed different corrosion rate and behavior from various interelectrode distances and voltage ranges. The results show that coin-cell with 6 mm thickness in the voltage range of 0.1-1.6 V at the current density of 0.5  $\text{Ag}^{-1}$  had the highest capacity of 122  $\text{Fg}^{-1}$ , and had superior stability compared to others.

### Publication with support of this project:

*“Modifying cell parameters improving Aqueous Aluminum battery performance; water-in-salt electrolyte”, to be submitted.*