Bandar seri begawan lithium-iron-phosphate batteries lfp

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The US Advanced Battery Consortium goals for low-cost/fast-charge EV ...

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(a) Schematic diagrams of the continuous hydrothermal flow synthesis reactor system. FeSO4 = Iron sulphate, VOSO4 = vanadium oxide sulphate hydrate and H3PO4 = phosphoric acid; P = pump; LiOH = Lithium hydroxide. (b) Outlines the mixing head, the central component of the apparatus where the reagents are combined.

The particles were recovered by centrifugation and washed with deionised water. The observed yield was 0.50 kg from 90 L of product suspension. The wet powder was freeze-dried and then subsequently heat-treated at 700 ?C for 3 hours (under flowing argon) to graphitize the carbon coating on the surface of the particles. The carbon content of the carbon-coated V-LFP was calculated to be 6.7 wt % C from carbon-hydrogen-nitrogen (CHN) analysis. The material was ball-milled for 1 h at 400 rpm using a Retsch planetary ball mill PM-200 using a 1:1 w/w ratio of LFP and N-methyl pyrrolidone (NMP) with 4 mm zirconia balls. The particle size distribution as a result reduced from a D90 particle size of 650 mm to 22 mm.

Silicon electrodes were prepared in multiple steps as outlined below. The composite electrodes were based on a combination of Si (purity > 99%, Elkem Bremanger): PAA polymer (Sigma Aldrich, MWT = 450 k, purity >= 99.5%) and conductive additives acetylene black (Alfa Aesar, purity 99.9%, S.A. 75 m2 g-1 and FLG (XG Sciences M Grade, purity > 99.9%, specific surface area specified in the range 120-150 m2 g-1).

A conductive additive mixture was formulated using 10.0 g FLG, 5.0 g acetylene black, 136.4 g deionised water and 1.0 g of 12 w/w % PAA solution to give a C loading of 11.7 wt %. This suspension was stirred at 500 rpm using a Primix Homodisperser (Model 2.5), followed by static ultrasonication using a Hielscher sonic probe (Model UP400S) using 0.5 cycles and an amplitude of 60% for two 7 min sonication steps.

Following degassing of the solution, anode coatings were cast onto 10 mm thick Cu foil (Oak Mitsui, electrodeposited), using a laboratory scale RK Instruments K Coating Proofer machine with a micrometer-assisted doctor blade coated. Electrodes were dried on a hot plate at 80 ?C, followed by vacuum drying (7 mBar) for 12 hours at 70 ?C. The above formulation resulted in electrodes with a dry mass % composition of 70:14:16 (Silicon: Na-PAA: carbon additives).

A cathode formulation of 80:10:10 wt % (V-LFP: PVdF: CB) was generated by mixing the V-LiFePO4 with carbon black (Timcal C65, Purity 99.9%, specific surface area 65 m2 g-1) and NMP (Sigma Aldrich). It is important to note that 6.64 wt% of the V-LFP material was carbon from the sucrose carbonization process, occurring from heat treatment of the V-LFP. The cathode was processed using the following steps:

A solution of polyvinylidene difluoride (PVdF) grade 5130 (Solvay) was formulated by dissolving 80 g PVdF powder in 920 g NMP. This was performed using a T2F Turbula mixing apparatus (WAB, Germany) for 12 hours until the PVdF is completely dissolved to produce a binder concentration of 8 wt %.

144 g V-LFP and 16.6 g acetylene black were dry mixed in a HIVIS high torque mixer at 10 rpm for 10 min.

208.1 g of the 8 wt % PVdF 5130 solution was added and the slurry was mixed for 30 min at 15 rpm.

50 g of NMP was added to reduce the viscosity of the solution, with further mixing for 35 min at 15 rpm followed by 30 min at 100 rpm.