ALLUAUDITE FRAMEWORKS FOR SODIUM BATTERIES

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Sodium-ion batteries are widely seen as an alternative to Li-ion batteries. In this scenario, the development of sodium batteries relies on discovery and optimization of oxide/ polyaionic insertion materials. Guided by the inductive effect principle, the redox potential of polyanionic cathodes can be altered with the electronegativity of constituent anions. Here, electronegative SO_4-based materials can deliver the highest redox potential vis-à-vis other polyanionic materials. In this spirit, alluaudite framework $Na_2Fe_2(SO_4)_3$ cathode has been recently reported offering ~100 mAh/g capacity with high rate kinetics and cycling reversibility [Nature Communications, 5, 4358, 2014]. It marks the highest Fe^{3+}/Fe^{2+} redox potential (ca. 3.8 V vs. Na/Na+). We have pursued this high-voltage Na-M-S-O quaternary alluaudite insertion family using low temperature solvothermal synthesis (T_r < 300°C) like (i) ionothermal method, (ii) spray drying route and (iii) Pechini synthesis. Using these green synthesis routes, we have explored other 3d metal homologues in Na-M-S-O quaternary system. Using experimental and DFT calculations, we will summarise the crystal structure, magnetic properties and electrochemical performance of high-voltage alluaudite framework cathode materials for sodium batteries.