P2-Type Orthotellurate Cathode Frameworks for Potassium-Ion Battery

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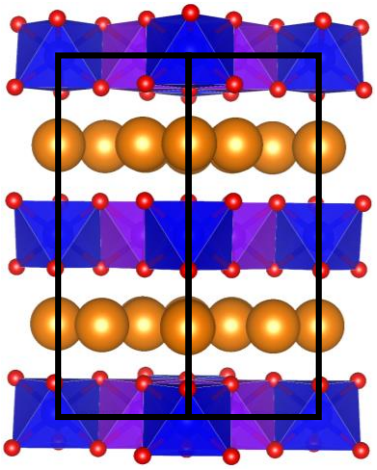
As a low-cost alternative to lithium, potassium-ion battery (PIB) has recently attracted great attention. Further, PIB can also be a high-voltage contender considering the significantly negative potential of the K^+/K redox couple, which is close to or even lower than Li depending on the solvent [1,2]. Nonetheless, the large ionic radius of potassium coupled with significant strain accompanying potassium (de)insertion, the number of potassium-based compounds (particularly, cathode materials) that can practically be utilized is limited.
Exploration of the broad class of orthotellurate frameworks has led us to identify new cathode frameworks that can reversibly (de) insert potassium ions, not only at high voltage but also at decent capacities. Figure 1 shows a layered crystal structure of $K_{2/3}Ni_{2/3}Te_{1/3}O_2$, a new cathode material synthesized via the conventional solid state method. The structure entails a honeycomb-like network of NiO_6 octahedra (in purple) surrounding each TeO_6 octahedon (in blue). Potassium atoms (in brown) occupy trigonal prismatic sites sharing faces with NiO_6 or TeO_6 octahedra.
During the meeting, we will highlight the synthesis, crystal structure and electrochemical performance of $K_{2/3}Ni_{2/3}Te_{1/3}O_2$ as a high energy density cathode material for PIB [3].

References:
[1] Y. Marcus, *Pure Appl. Chem.*, **57** (1985) 1129-1132.
[2] S. Komaba, T. Hasegawa, M. Dahbi and K. Kubota, *J. Power Sources*, **60** (2015) 172-175.
[3] T. Masese, K. Yoshii, T. Okumura, H. Senoh, M. Shikano, *manuscript submitted.*



Figue 1. Schematic presentation of $K_{2/3}Ni_{2/3}Te_{1/3}O_2$ viewed along [110] direction. NiO_6 tetrahedra (blue), TeO_6 octahedra (purple), and K atoms (brown) are illustrated.