Electrochemical and theoretical investigations of $Na_2Ti_3O_7$ and $Na_2Ti_6O_{13}$ as Na^+ intercalation anodes

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Potential problems with lithium availability in the future may demand the use of other charge storage chemistries for high capacity applications such as grid storage. Rechargeable Na^+ batteries could help meet this demand due to its ubiquity throughout nature. While several high voltage cathodes have been identified for Na^+ rechargeable batteries, viable low voltage anodes have been scarily identified. Here we present electrochemical and theoretical investigations of two sodium titanates, $Na_2Ti_3O_7$ and $Na_2Ti_6O_{13}$ as low voltage (ca. 0.5 V vs Na^+/Na^0) Na^+ intercalation hosts. At 800 °C the layered $Na_2Ti_3O_7$ condenses to $Na_2Ti_6O_{13}$, which exhibits a more 3-D microporous structure. These structural changes may have implications for understanding Na^+ insertion mechanisms and will be explored through combined experimental and density functional theory (DFT) studies.

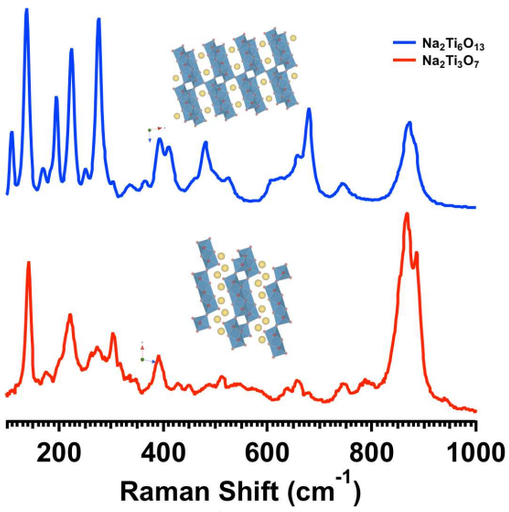

Figure 1. Raman spectra of the sodium titanates under investigation along with their crystal structures.