Electrochemical Applications of TiO2 Hollandite in Touchscreens

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This research was aimed at creating and testing hollandite, a synthetic polymorph of titanium dioxide (TiO2), for its potential as an alternative to indium tin oxide (ITO) in touchscreens. Due to its unique chemical properties, low toxicity, and abundance, TiO2 has been thoroughly studied for varying applications. In this experiment, the conductance of potassium hollandite (KTiO2) was recorded after exposure in a furnace at varying lengths of time to create oxygen vacancies. The null hypothesis states that the length of time in the furnace will either have no effect or a negative effect on conductance. To create the KTiO2, TiO2 anatase and K2CO3 were mixed in a mole ratio of 1:9 and pressed into equally sized pellets. The pellets were placed in a furnace for eleven hours at 1050 °C in 5% hydrogen/ 95% nitrogen. After eleven hours, the pellets were taken out and their conductance was measured. The pellets were returned to the furnace under the same atmosphere for two 4-hour intervals at 650 °C. Between each interval, their conductance was measured. At an alpha level of 0.05, the null hypothesis was rejected. The conductance of the KTiO2 significantly increased after the first 4-hour interval, and further increased during the second 4-hour interval. While results were promising, the potassium cations must be removed in order to be transparent in touchscreens. Thus, the eventual goal of this study is to determine if the potassium hollandite can be de-intercalated, without causing it to decompose or lose its conductance. This future research could lead to the emergence of TiO2 hollandite as a viable alternative to ITO.