Siemens Competition
Math : Science : Technology
Regional Finalist

Names: David Huang and Eric Cheng
High School: Troy High
Mentor: Yang-Tse Cheng
Project Title: *The Synthesis, Structure, and Characterization of LiNi0.6Co0.2Mn0.2O2 as a Lithium Ion Battery* (Materials Science/Nanoscience)

Three types of LiNi0.6Co0.2Mn0.2O2 cathode material were synthesized by solid state reactions under various conditions. The samples were characterized by X-ray powder diffraction and electrochemical measurements. Performance of cathode materials is closely related to the degree of cation mixing disorder, which was determined by X-ray diffraction refinements on the occupancy of cations. The reaction of conventional precursors Ni1-xO, CoO, and MnO2 with Li2CO3 at high temperatures (e.g., 850oC) produces a highly disordered structure (Type I) with a capacity of only 80 mAh/g, while at moderate temperatures (750 and 600oC), it gives an ordered structure (Type II) with a capacity of 101 mAh/g. Replacement of conventional precursors by NiCO3. 2Ni(OH)2,Co(OH)2 and Mn(CH3COO)2.4H2O resulted in a highly ordered structure with good crystalline particles (Type III). The Type III material performs the best with a capacity of more than 153 mAh/g.