Franklyn Edison Colmenares-Ochoa

Major: Mechanical Engineering
University: Polytechnic University of Puerto Rico
Faculty Mentor: Dr. Mark Prelas
Mentor Department: Nuclear Science and Engineering Institute (NSEI)

Funded by: Louis Stokes Missouri Alliance for Minority Participation

Surface treatment of diamond powder with sodium chloride, to enhance hydrogen strorage for use in fuel cells

In the fuel cell industry, one of the main problems is storing hydrogen in a safe way and how to extract it economically. Hydrogen requires high pressures which could be very dangerous in case of a collision. Also the total weight of the tank and hydrogen (negligible compared to the tank) is 23 times greater than an average gasoline tank and 15 times by volume. Many companies have developed cars that work with fuel cells but many of these use high pressure tanks as a storage resource. Today fossil fuel is the main source of energy in the world, covering over 80% of these needs, and most of this fuel has its use in transportation systems. Therefore, the use of hydrogen in transportation can significantly reduce the dependence on fossil fuel. The success of hydrogen use depends largely on the development of an efficient storage method. In effort to develop a better hydrogen storage system for fuel cells technology this research investigates the use of diamond powder for storing hydrogen. The diamond powder used in this study was 99% pure, but it is not expensive because it is a synthetic powder made in a chamber with carbon particles that are exposed to an explosion, producing a shockwave that converts the carbon particles into diamond powder. Mixing this powder with a sodium chloride compound in its solid form and treating the surface of the powder with hydrogen plasma, modifies the surface of the diamond. After some filtration through distilled water and drying, the diamond is treated with hydrogen. We expect hydrogen to be attracted to the diamond powder surface in higher quantities due to the NaCl treatment. Due to the large surface area of diamond nanopowder and the electronegative terminal bonds of the chlorine particles on the structure’s surface, to the method shows promise in storing high densities of hydrogen.