TITANIUM OXIDE-BASED SELF-CLEANING SENSOR FOR THE DETECTION OF ALIPHATIC PETROLEUM COMPOUNDS. Vincent A. Rosa[1,2], Jorge H. Torres[1,2], James D. Sweeney[1,2], Patricia D. Barreto[1], Jose C. Barreto[1,3], Green Technology Research Group[1] (GTRG), Departments of Bioengineering[2] and Chemistry[3], Florida Gulf Coast University, 10501 FGCU Boulevard South, HE 331, Fort Myers, FL 33965.

Due to the need for a sensor that detects aliphatic hydrocarbons, we have taken advantage of the semiconductor properties of titanium (IV) oxide (TiO_2) to prototype an inexpensive sensing interface for such compounds. This prototype sensor has the potential to be “self-cleaning” and reusable because of TiO_2’s photocatalytic properties. We constructed the prototype by coating thin layers of nanoparticle titanium oxide to the surface of an Interdigitated Array (IDA) Electrode. An IDA consists of 65 pairs of platinum electrode digits, each 5 µm apart from its counters. Testing revealed that the electrical conductivity of our TiO_2-coated IDA (C-IDA) interface is significantly reduced when it is exposed to a hydrophobic compound. This testing consisted of applying a five-second, 1V pulse across a C-IDA while measuring the resulting current. During the voltage application and data acquisition, PET (petroleum ether, a mixture that contains aliphatic hydrocarbons) was allowed to evaporate within a sealed glass chamber containing the C-IDA. Subsequent “cleaning” of the coating was performed by illuminating it under UV light, which engendered photocatalytic destruction of the PET. The results show that the presence of PET vapor decreases the current to half or less than half of the original base value, which was obtained from controls using no PET and was recovered with the application of UV light. Our results show that our device detects PET vapor, is “self-cleaning,” and has the potential to be a reusable petroleum sensor.