Russell R Chianelli, J Pet Environ Biotechnol 2017, 8:5 (Suppl)
DOI: 10.4172/2157-7463-C1-036

Russell R Chianelli

University of Texas at El Paso, USA

Transition Metal Sulfide (TMS) catalytic materials for solar catalytic reforming of methane and CO_2: *Quench the Flare*

The United States, Canada and Mexico are now being called the "New Middle East" because of their huge production of oil and gas from both conventional and shale sources. This new hydrocarbon production produces two waste materials in large quantities: natural gas and tars1. The gas is typically burned away in flares because it is cheaper to burn than to liquefy and sell. A recent NASA study revealed that space stations flying over Siberia reported thousands of flaring oil wells from conventional oil wells, burning as much energy as the East Coast of the United States uses for travel every day2. The same phenomenon has been reported in the western states of the United States (figure 1). Flare gas is typically comprised of approximately 50% methane and 50% CO_2. Catalytic reforming of methane with CO_2 is possible using catalytic materials producing valuable hydrocarbons that are liquid at room temperature. However, his reaction occurs at temperatures near 700°C. Thus, the cost of implementing this process in petroleum fields is too high. We have developed "Flare quenching" methods using novel catalytic materials for the reforming using solar power to convert the waste to useful products3. The Infrared Spectrum of the liquid products (hydrocarbons and alcohols) is shown in figure2. In the early 1980's the periodic trends of TMS catalysts on unsupported catalysts were discovered and these results formed the foundation for further basic understanding of the key properties that led to catalytic activity4. Progress has been made by combining synthetic, experimental and theoretical techniques. Theoretical studies support the fact that the d-electrons in the frontier orbitals of the catalysts were key in determining catalysis at the surface. The triumph of this approach was that it unified the promoted TMS systems with the binary TMS and provided a common rational for the activity of both. Novel preparations that enhance activity and selectivity have been developed5. These catalysts have been applied to the solar catalytic reforming project.

Figure1: United States gas flare

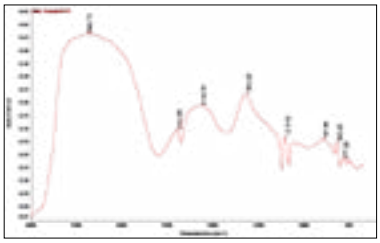

Figure2: Product from Solar Reforming

Biography

Russell R. Chianelli is a professor of Chemistry and Director of the Materials Research and Technology Institute at the University of Texas at El Paso. Formerly at member of Exxon Research and Engineering's Corporate Research Laboratory, Dr. Chianelli is a world authority on Transition Metal Sulfide Catalytic Materials with over 200 peer reviewed publications and over 60 issued U. S. Patents. His work is highly interdisciplinary and covers theory, experiment and application with commercialization's based on his work. In 1990 he was the President of the Materials Research Society and scientific leader of the Exxon Valdez oil spill successful bioremediation effort. He has received several recognitions for his work and continues to lead in the understanding of Transition Metal Sulfide catalytic materials and their application to petroleum refining and coal gas catalysis.

chianell@utep.edu