

Lecture at Facultad de Minas, National University of Colombia Medellin  
14<sup>th</sup> March 2017 at 2 pm

## **Sensitive Diagnostics for Chemical Kinetics**

### **Abstract**

Increasingly stringent emission regulations, global warming, and depleting fossil fuel resources are driving the design of combustion systems towards extreme operating conditions. Ultra-lean fuel mixtures, very high pressures, and low temperature combustion are some of the directions being pursued currently. In such domains, fuel chemistry and reaction kinetics play critical role in the design and optimization of combustion systems.

Common facilities for the study of homogeneous chemical kinetics include shock tubes, rapid compression machines, combustion bombs, flow reactors, well-stirred reactors, and motored engines. Of these, shock tubes provide the most ideal environment to investigate fuel chemistry in the absence of heat transfer and fluid dynamic effects. Shock tubes are generally used to measure ignition delay times of fuel/oxidizer mixtures under varying conditions of temperature, pressure, and stoichiometry. However, when coupled with *in-situ* sensitive diagnostics, shock tubes can provide measurements of reaction rate coefficients and species time-history profiles. Such data are extremely useful in the development and validation of detailed chemical kinetic models.

This talk will feature some latest diagnostic developments for sensitive detection of gas temperature and important combustion species, such as acetylene, ethylene, hydrogen peroxide, hydroxyl radical and free electrons. Advanced optical strategies, such as intrapulse chirping, wavelength modulation, cavity ringdown and microwave interferometry are employed. It will be demonstrated how the application of these diagnostics enables deeper insights into complex reaction mechanisms and chemically reacting flows.

### **Short Biography**

Dr. Aamir Farooq joined KAUST in 2010 after earning his MS and PhD degrees in Mechanical Engineering from Stanford University, USA. Professor Farooq's research interests are in the areas of energy systems, fuel formulation and laser-based sensors. Dr. Farooq and his research group focus on high-temperature infrared spectroscopy of hydrocarbons, novel quantum-cascade laser-based sensors, and chemical kinetics of fuel formulation. He has published over 80 archival papers in premier journals related to optics, lasers, sensors, fuels, energy and combustion. He has given several invited talks at leading international conferences and has organized technical sessions and workshops

<https://kinetics.kaust.edu.sa/Pages/Home.aspx>