The Development of 10KW Chemical Looping Combustion Technology in ICSET, WKU

Yan Cao, Kai Zhang and Wei-Ping Pan
Institute for Combustion and Environmental Technology,
Western Kentucky University, US
North China Electric Power University, Beijing, China

Institute for Combustion and Environmental Technology (ICSET) of Western Kentucky University (WKU), has been working on the development of chemical looping combustion technology (CLC) over 8 years. The unique properties of copper-based oxygen carriers have been intensively studied, which are organization of both coupling and uncoupling reduction of fuels. After mastering controls of constant solid re-circulation, the prevention of gas leakage between the air and fuel reactors and the finalized formula of oxygen carrier, a10 kW hot model CLC system has been established and successfully operated using natural gas and pyrolysis syngas in 3 days, 8 hours each day. The next step of the development of CLC in ICSET would be the system modification of the current available of 0.6 MW CFBC system into 1 MW CLC system.

Mercury Emission, Control and Measurement from Coal Combustion

Yan Cao, Kai Zhang and Wei-Ping Pan
Institute for Combustion and Environmental Technology,
Western Kentucky University, US
North China Electric Power University, Beijing, China

During the coal combustion process, when both sampling and accurate measurements are challenging, we know that mercury is present in three species: elemental, oxidized and particulate. There are three basic types of mercury measurement methods: Ontario Hydro Method, mercury continuous emission monitoring systems (CEMS) and sorbent-based monitoring. Particulate mercury is best captured by electrostatic precipitators (ESP). Oxidized mercury is best captured in wet scrubbers. Elemental mercury is the most difficult to capture, but selective catalytic reduction units (SCRs) are able to convert elemental mercury to oxidized mercury allowing it to be captured by wet flue gas desulfurization (FGD). This works well for eastern coals with high chlorine contents, but this does not work well on the Wyoming Powder River Basin (PRB) coals. However, no good explanation for its mechanism, correlations of chlorine content in coal with SCR performance, and impacts of higher chlorine content in coal on FGD re-emission are available. The combination of SCR and FGD affords more than an eighty percent reduction in mercury emissions in the case of high chlorine content coals. The mercury emission results from different coal ranks, boilers, and the air pollution control device (APCD) in power plant will be discussed. The oxidation and adsorption rate of HBr and fly ash will also be discussed in this presentation.