Effect of SiO$_2$/Al$_2$O$_3$ on fusion behaviour of coal ash at high temperature

Tinggui Yan$^1$, Jin Bai$^1$, Lingxue Kong$^1$, Zongqing Bai$^1$, Wen Li$^1$

$^1$Institute of Coal Chemistry, Chinese Academy of Sciences, Taiyuan, China
email (Presenter): stone@sxicc.ac.cn

The fusion behaviour of mineral matter in coal at high temperature provide more information on the suitability of a specific coal source for combustion or gasification purposes. The fusion behaviour display different characteristic during heating, including shrinking which is due to liquid sintering, eutectic melting that generate mass of liquid phase quickly and flowing at the later period of fusion[1]. The traditional methods to evaluate fusion behaviour, like ash fusion temperature test, do not provide enough insight into the fusion behaviour of coal ash at high temperature for the discrete result. However, some advanced technologies, thermo-mechanical analysis, high temperature processing microscope etc., are able to measure or observe the sample continuously, which make it possible to get a better understanding of the fusion behaviour during the whole heating process[2, 3].

The object of this study is to clarify the effect of SiO$_2$/Al$_2$O$_3$ (S/A) on ash fusion behaviour at various period and, hence, on deposition and slagging potentiality of ash at high temperatures. Ash fusion temperature test was carried out to explore the influence of S/A on fusion temperature. Thermomechanical analysis and a microscope with a hot stage were used to observe the fusion process of ash during melting. Mineral compositions of ash were subsequently determined and quantified by Siroquant, which provided insight into the reactions and mechanism of the fusion process. The thermo-analysis was conducted for all the samples to further study the kinetics of the fusion process.

The results shows ash fusion temperature decrease sharply until the S/A reaches 3.0 while increase slightly when the S/A is higher. The sintering behaviour at the first period initialized by the initial liquid phase which is influenced by S/A greatly when S/A is below 2.0. The rate of eutectic melting at the second period is determined by the crystal content, since crystal usually melt more quickly than amorphous without a melting point. The observation from microscope indicate that amount the refractory particle remained above flowing temperature also varies with S/A.

References