After detailed literature review, the scope of the problem and objectives of the present study have been formulated. The present investigation is focused on the solid particle erosion evaluation of SA192 and SA210GrA1 boiler steel at ambient and high temperature conditions.

As explained, components in energy generation systems required to operate at high temperature, which suffer from variety of degradation processes due to complex multi component gas environment. This aggressive boiler operating environment results premature failure of the boiler tubes due to erosion. The development of wear and high temperature resistant system in industrial boilers is a very important topic from both engineering and an economic prospective.

There are many environments in power generation processes where boiler components experience mechanical wear. High temperature erosion of boiler tubes due to fly ash in combustible flame in the coal fired boilers is recognized as the main cause of downtime at power generating plants for 50% to 75% of the total arrest time.

The combustion products of pulverized coal for the purpose of generating heat in a thermal power station are coarse ash, fly ash and flue gases. The coarse ash or bottom boiler ash consists of 10 to 20% of the total ash load and fly ash consists of 80-90% of the total ash load. As suggested by the term “boiler bottom ash” the coarse ash drops out of the bottom of the boiler under the influence of gravity after combustion, while fly ash entrained in the flue gas is ducted out. This fly ash creates critical high-temperature fireside erosion of boiler tubes. So erosion problem of the boiler tubes require some preventive measures.

Erosion-corrosion resistant materials for combustion environments are highly alloyed and thus expensive. Also, the mechanical properties of corrosion resistant alloys may not meet the requirements of structural components. The problems associated with workability, mechanical properties, and high material cost need
consideration to provide optimum solution. Due to the continuously rising cost of the bulk materials as well as increased material requirements, the surface treatment techniques have been given more importance in the current times. Therefore, the use of friction stir process has been identified as a potential area for the present research.

Solid particle erosion has been declared as the main reason of boiler tube failure by various researchers. The case studies of National Fertilizer Limited Naya Nangal, have pointed out the frequent boiler tube failure of bank tubes and economizer tubes. So, it was decided to conduct the solid particle erosion study on SA192 and SA210GrA1 boiler steel for the investigation of erosion mechanisms. The erosion test was proposed to conduct at ambient temperature and at high temperature conditions so that tribological behavior of these steels can be evaluated at different temperature. To conduct the erosion test, isothermal erosion test rig TR-471-M10 was selected to generate the actual working conditions of boiler.

The experimental investigation was proposed to conduct on SA192 and SA210GrA1 boiler steels in three stages; the first experiment was proposed carry out at ambient temperature in which steel sample and air temperature were set at 25°C and impingement angles of air jet varied as 30°, 45°, 60° and 90°. Alumina powder of 50 micron average size and irregular shape was selected as erodent which has resemblance with the fly ash in the combustible flame. Each test was proposed to conduct for continuous three hours. The velocity of air jet containing erodent was maintained at 35 m/s and feed rate of erodent of 2 gm/min was selected. Second experiment was proposed to conduct at high temperature conditions in which steel samples were heated to 600°C and air temperature was maintained at 800°C and impingement angles of air jet varied as 30°, 45°, 60° and 90°. The third experiment was proposed to conduct on friction stir processed steel samples of SA192 and SA210GrA1 boiler steels at high temperature conditions in which steel samples were heated to 600°C and air temperature was maintained at 800°C and impingement angles of air jet varied as 30°, 45°, 60° and 90°.

After the erosion test the macroscopic and microscopic examination was carried out. The macroscopic examination was done for visual inspection, material loss calculation and surface roughness degradation. Microscopic examination was done for SEM analysis, XRD analysis, EDS analysis and EBSD analysis. Different erosion mechanisms were investigated at ambient and high temperature conditions. The change in temperature from ambient to high temperature experimentation
conditions will give idea about extent of material degradation with increase in temperature. The third experiment proposed on friction stir processed steel samples at high temperature will compare the results and investigate the scope of protection of material with FSP. Tribological characterization was proposed for these steels against solid particle erosion.