

Conjugate Heat Transfer Simulation of Argon Gas Heater for ARPS in Pyroprocessing Facility

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Abstract

PyroProcessing Research and Development Facility (PPRDF) is being setup in IGCAR to develop pyroprocessing technology. It consists of a large argon cell attached with Argon Recirculation and Purification System (ARPS). Once through Argon gas heater is an important process equipment in ARPS to heat argon from room temperature to 100oC. The heated argon is used for effective regeneration of catalyst bed.

The once through Argon heater consists of rectangular duct of 500mm height, 250mm width and 300mm breadth. Argon heating is done with series of finned U shaped electric heaters. The argon gas enters from bottom at room temperature and comes out from top at around 100oC. The total electrical power of heater elements in the duct is 18KW and flow rate of the argon is 525 Nm³/h.

The Conjugate Heat Transfer (CHT) simulation of once through gas heater using heat transfer module of COMSOL® was carried out. The objective of this study was to validate the design, to know the time required to rise the argon temperature and to obtain the temperature of individual heating element to avoid the hot spot.

From the simulation result it was found that the argon temperature can be raised above 100oC using once through gas heater. The temperature distribution from the analysis also shows that the individual heater element temperatures at surface are within the required range. Encouraging results have given us the confidence for the finalization of the heater elements arrangement for the gas heater and for giving final clearance to fabrication drawing.

Figures used in the abstract

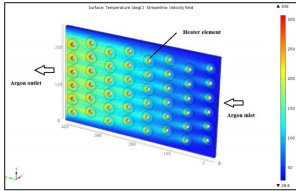


Figure 1: Sectional view of the Argon Temperature distribution inside the Gas heater along with streamline plot of argon velocity field