TROUBLESHOOTING AND PERFORMANCE IMPROVEMENTS IN ClO2 GENERATOR USING CFD: AN ONGOING STUDY

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Abstract:

Computational Fluid Dynamics (CFD) has emerged as an effective simulation tool over the past two decades. CFD comprises three major steps in arriving at the solution: (1) Geometry generation and meshing, i.e. resolving the large flow domain into small cells (2) Numerical Simulations (3) Post-processing,i.e. interpreting the results. Many design and EPC companies are gaining the benefits of CFD tools through process design and troubleshooting. As regards the field of Chemical Engineering, CFD is finding increasing applications in the areas of design and scale up, performance improvements and troubleshooting. This is particularly important for the technology companies like thyssenkrupp. In the present study, we have discussed the application of CFD in troubleshooting and performance improvements in ClO2 generator.

1. Problem statement

ClO2 is produced by reacting sodium chlorate with hydrochloric acid:

$$NaClO_3 + 2HCL \rightarrow NaCL + H_2O + \tfrac{1}{2} Cl_2 + ClO_2$$

In the actual equipment, HCl is added to the pool of sodium chlorate at multiple points. Thus, ClO2 is produced discretely in the liquid pool of chlorate. The consequence of this is, that the local concentration of ClO2 varies. It has been observed that, if the local concentration of ClO2 goes above a certain value, the phenomenon of puffing occurs, which is recognized by violent explosions, that eventually lead to shutdown. Thus, puffing has implications both in terms of safety and economics. To deal with this, in the current system, air is spared at different points in the chlorate pool. This is done with the intention of reducing the local concentration of ClO2 below the critical value for puffing. The overall configuration is thus a complex system of three components. The effectiveness of the operation essentially depends on the hydrodynamics within the liquid pool.