Based on our previous mechanistic study of the heterogeneous catalytic oxidation of elemental mercury (Hg(0)) vapor over cupric chloride ($CuCl_2$)-based catalyst, the reaction kinetics was studied. The objective of this work is to determine the reaction kinetics for the reaction of Hg(0) with $CuCl_2$. The oxidation reaction has been considered as a gas solid reaction, and a grain model was developed to determine the Hg (0) oxidation reaction under different Hg (0) concentrations and temperatures. A relationship between the local conversion of cupric chloride and reaction time was obtained, and a comparison between simulation and experimental results was made. The detailed simulation and experimental results will be presented.