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Load Servo Flue Gas Selective Catalytic Reduction Denitration Control Strategy Optimization Study and Engineering Application

Hang Zhang

Inner Mongolia University of Technology, Shijiazhuang

Abstract:

Ureapyrolysisammoniainjectionsystemwasinvestatedastherresearchobject.(SCR)Systemandavoidammonialeak. fuzzyalgorhmandfeedforwardfeedbackcontrolmethodeutilized,AndnoXConcentration,Boilerloadingandammonialeakwe rechosenashecontrolparameters.

theoptimalsolutionofureplysiscontrolwasproposedtocontrolnoXConcentrationofscrautomaticaly. Thecontrolstrategy wasappliedtocontroltheammoniasprayratetheproject.XEmissioncouldbeachievedsteadily,Andtheammonialeakwaslowert han2.5mg/M3.Whentheboilerloadingfluctuatedgreatly.

Keywords: Ureapyrolyticammoniaspray·Controlstrategy·Loadingfluoration·Engineingapplicatio

In order to achieve control process of OptimizationFirst need to determine control process of input output parameters and System DisturbanceIncluding system internal disturbance and external disturbance.Disturbance main from system process parameters of change the denitrification efficiency of influenceSo it is necessary to analyze Denitrification Process

System specific process is according to reactor importNO_XConcentration,Oxygen Content,Flue gas volume of value and given of ExportNO_XConcentration Upper LimitCalculation the given EfficiencyAgain by actual monitoring of the importNO_XConcentration value calculation Actual EfficiencyBoth do deviation calculation afterDenitrification efficiency deviation main controller inputThePIControl AlgorithmOutput as an urea flow Deputy Controller to valueShould value with flowmeter actual measured of urea flow do deviation calculationThe deviation as an Deputy Controller InputDeputy Controller stillPIControl AlgorithmControl output to direct regulation urea flow control valve of OpeningControl into the pyrolysis of ureaAccording to urea pyrolysis reaction of ammonia of Moore than relationship complete spray ammonia of the control[14].

But in actual operation process inAnd liquid ammonia method Denitration usually application of large fire generator set differentUrea pyrolysis Denitrification Process of Application Object for Small and Medium BoilerIts operation characteristics for short-term Load Fluctuation big,Temperature Stability difference,Combustion condition changingFrom existing of urea pyrolysis Cascade Control System Application EffectIn load change rate slow, NO_XInitial Concentration fluctuation fierce underOften will appear Control tracking don't timelyLead to exportNO_XEmissions abnormal and ammonia escape exceed the standard of situation.From figure2In Import and Export Flue GasNO_XConcentration,Boiler Efficiency of change curve and ammonia escape Curve ComparisonWhen boiler efficiency and importNO_XConcentration gradually l highControl Valve advanced actionOpening increase is too largeLead to urea flow

increase too fastExcessive spray ammoniaAmmonia escape significantly increaseLead to exportNO_XFar lower than to value.

Existing control system difficult to long time stable operationDue to control valve Regulating the travel need timeControl Valve Opening in frequent adjustment of StateControl Accuracy difficult to assuranceTherefore shall be have targeted to Optimization Control Strategy.

So in design controller of problem on the main attention the following3A Problem:(1)How to solve the signal there is a long time of lag problem; (2)Flue gas and reducing agent in catalyst role under the reaction time there strong nonlinear; (3)In assurance denitrification efficiency of premise.How to reasonable control ammonia escape of problem?.

For the existing urea pyrolysis denitrification Control Strategy in the ProblemThis study put forward the urea pyrolysis spray ammonia control strategy of optimization scheme.In"Two-dimensional fuzzy+Feed-forward Feedback Control"Means based onAccording to the boiler load ImportNO_XConcentration of changeRapid Adjustment spray ammoniaEnsure the efficiency stability and ammonia escape Standard.Specific control strategy are as follows:

(1)ByO_2Concentration will import and exportNO_XConcentration conversion6% O_2Under the numericalUnified Calculation StandardEasy to feed-forward link operation.

(2)According to fixed of Ammonia, NO_XMooreBy denitrification Control System Calculation the required of urea Flow.By denitrification reactionAmmonia andNO_XIn accordance with ammonia andNO_XMoore than1The reactionBut in field debugging during according to actual situation determine Moore than corresponding relationshipAnd record in Flow Control System on.Income urea solution flow signal was convey to controller and real value the compareByPIProcessing the produce of deviation send to urea flow control valve Positioning.The process superposition system feed-forward and closed-loop control output signalBy the feed-forward process to ensure that system can real-time tracking Load Fluctuation and importNO_XConcentration of changeOvercome simple cascade control system tracking don't in time of Problem.

(3)On the basis of ExportNO_XTo value and exportNO_XMeasured get export deviation signalAnd will the signal input urea solution flow control system program on.To exportNO_XConcentration deviation and its change rate for input parametersThe two-dimensional fuzzy controller implementation Denitration Automatic Control;By calculation income of ammonia demand signal control urea solution flow control valveTo

Control valve opening as an fuzzy controller output signalBy regulation the load when the flow get suitable spray ammoniaAchieve accurate control urea FlowAssurance ammonia escape meet requirementsNot in ammonia excess Phenomenon.

(4)According to design requirements the maximum ammonia escape $\leqslant$2.5 m_G/M^3In control output is set ammonia escape control incremental.When ammonia escape measured to ammonia escape control die areaLock urea flow control valve opening upper limitAt this time such as control output greater than opening upper limitActual output still according to the set of opening upper limit output.

Control Strategy Optimization after control structure see Figure3,Based on optimization of control strategy structureThis study put forward the control strategy of specific algorithm processAnd will the applied to more a urea pyrolysis of Flue Gas Denitration engineering inMade the is good regulation effect.

Will urea solution flow deviation as an input signalPIOperationGet feed-forward controller of output flow deviationAgain according to urea flow control valve of performance curve determine urea flow control output incremental and control valve opening incremental of corresponding relationshipIn feedback controller control output play beforeFirst Regulation urea FlowThe urea flow can quickly response flue gas load andNO_XInitial Concentration and Fluctuation.

Fuzzy control is a kind of computer digital controlTo Fuzzy Set Theory,Fuzzy Language variable,Fuzzy logic reasoning for FoundationUse Fuzzy mathematical imitation human brain thinking styleRecognition and decision fuzzy PhenomenonOutput accurate controlTo achieve the charged with object of control[15].Because this study of spray ammonia of control process its object of dynamic characteristics with the boiler operation conditions of change and

greatly changeDifficult to get more accurate of the number

Of Model.At the same time boiler operation process inOften there are many kinds of system disturbance coexistence and common role of situationSo special for the fuzzy control

System means to achieve controlFuzzy Control of characteristics for without the Object ModelingThe computer simulation manual control to Regulation object.

Fuzzy control work process:First based on manual control experience get complete control rulesThen in accordance with the system operation Present SituationBy Fuzzy Reasoning,Fuzzy Decision and style get controlImplementation of object of control.Urea flow Fuzzy Controller basic structure see Figure4.

For Fuzzy input variablesBAAndCAIts Fuzzy subset as follows style Division:

The triangle membership function and maximum membership degree Method to Determine the fuzzy inputComplete fuzzy controller input and output variable of fuzzy work.For this study of urea solution flow controllerFor convenient follow-up Fuzzy Relationship CalculationControl Rule Base said for such as table1Shown in the matrix form.

This study established of urea pyrolysis Denitration urea flow optimization control strategy has been applied to a urea pyrolysis flue gas Denitration engineering inMade the good of Application Effect.To Nantong A Denitration project application optimization control strategy run record data as an Example(See figure5),By control valve opening and denitrification efficiency,Import and ExportNO_XConcentration and ammonia escape of relationship curveCan seeIn load andNO_XImport concentration change whenDenitrification efficiency were can achieve stabilityNumerical Stability in80% ~ 90%,Flue gas Continuous Emission Monitoring System(CEMs)The test value and stable up-to-standardSystem run stable reliable.

System Operation Process inBy the control strategy control of urea flow tracking timelyFeed-forward system assurance inSCRReactor ImportNO_XInitial Concentration Change and boiler load change whenUrea flow control valve timely action.Regulation Process Ride ComfortExportNO_XConcentration Change for urea flow fuzzy controller of fine-tuneCan keep

To Jinan a urea pyrolysis flue gas Denitration engineering as an ExampleThe engineering

Like2×70 MWFluidized Bed Hot Water BoilerA single boiler flue gas volume

The Denitration engineering the application. This study of urea Flow Optimization Control

System StrategyTo the engineering debugging during continuous operation24 hThe actual data as an ExampleDenitration efficiency and control valve opening curve as shown in Figure6Shown inImport and ExportNO_XConcentration and control valve opening curve as shown in Figure7/Shown in.

From figure6In can seeWith the control strategy of control output changeControl Valve Opening corresponding changeEven if control valve opening change is big of situation underDenitrification rate is high in85%And keep stability.

From figure7/In can seeNO_XImport concentration for System Object disturbance signalIn24 hTime range in the obvious changeBetween$_{250\ \sim\ 380\ mg}/M^3$With its deviation changeControl Valve accurate the opening of timely adjustment(Optimization Control Strategy timely tracking the system disturbance of change.And from figure6We can know thatThis process in denitrification efficiency basic stabilityThis (ImportNO_XChange the control object of disturbance influence by the control strategy of control output regulationNot the control object significant influenceControl quality meet the control object of requirements.

To importNO_XConcentration,Flue gas load,Ammonia escape parameters as an feed-forward control link of input variableBy chemical reaction process of material balance relationship andPIController Operation Get feed-forward control of outputDirect on Urea flow control valveImplementation Control System on Disturbance of fast tracking.At the same time to exportNO_XConcentration deviation and its change rate for fuzzy input variablesTo urea flow increment for fuzzy output variable?Build two-dimensional Fuzzy ControllerSuperposition control output and feed-forward control output signal afterCorrection fine-tune the feed-forward control output to accurate stability control the whole

Denitrification Process.

From Engineering of actual operation situationIn24 hCycle of Flue Gas Denitrification debugging time period inApplication This study of Flue Gas Denitration spray ammonia optimization control strategy very well overcome the boiler heat load change and negative

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