



Compound Oxide Catalysis CO-SCR Mechanism Research

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Abstract: A series. Ce-co-ox Catalysts. prepared by co-precipitation method, CO-SCR performance. Studied. influence CO, CE ratio. activity. CO-SCR. investigated, Ce (0.3)-Co (0.7)-O_x Sample showed Highest NO conversion efficiency 84% at 250 °C. according. characterization: it. proposed, active sites. CO-SCR. Co. Ce (0.3)-Co (0.7)-O_x. There. two reasons responsible. enhanced catalytic performance by Ce doping. Ce-co-ox Catalyst. firstly, specific surface area, pressureswing capacity. increased. Ce doping. Secondly a solid Solution. formed. Ce-co-ox Catalyst, resulting in the enhanced oxygen migration rate. The CO-SCR is lively to follow a mechanism that gaseous or weakly-adsorbed CO returns with adsorbed NO specialties in the forms Bridging bidentate nitrite and chelate nitrate.

Keywords: Cerium Oxide; Cobalt Oxide; CO-SCR; Weak adsorbed CO; Bridging bidentate nitrite species

One of the major atmospheric dyes., Nitrogen Oxides (NO_x) It is an important precursor to the formation of secondary particles and ground-based ozone.. It does not harm the environment, And Human Health also exists.. The main source is the flue gas and machine emissions from the fire, plant, engineering, furnace, etc.^[1]. With the rapid increase of steam ownership, Machines, exhaust emissions NO_x Emissions, increasingly., Machine, tail gas containing CO, HCEqual Dye. Utilization CO Catalytic Activity NO_x (CO-SCR) Is one of the viable technologies^[1-4]. Its technology, the principle is through catalysis CO And NO Simultaneous removal. There are a lot of research Pt, Pd, IREqual metal Catalysis^[3]. But there are rare sources of metal catalysis., Disadvantages of high cost. Therefore, Open, efficient Catalytic System, Especially Metal Oxide Catalysis, Has received widespread attention.

Currently, More research on Metal Oxide catalysis, there are Cu, Fe, Mn And CE Metal Oxide Catalysis^[4-10]. Among them, CE The oxide can play a role in promoting the dispersion of active points on the surface.^[2-3], Increase, body, qualitative^[2], Increase the specific surface of Catalysis, Overflow flow and improvement of Metal Oxide

Some research, No/CO Anti-can effective of Suppression NO₂ emissions Xu chun bao and^[10] Of research in 500 Under different non-metallic catalytic NO Remove the anti-of catalytic activity by high low of order: Fe₂O₃ > Ni₂O₃ > CuO > Cr₂O₃ > V₂O₅ >

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Cu₂O> MnO₂. Guo Lei and^[11]TheCEModifiedNi-Al-O_xCatalytic has benignCO NOAnti-in addition to nitrogen oxide of Effect.ButCOIs very good removalNO_xOf originalIf anti-system inO₂ThereCatalytic of activity will be big of influence.ThisStudy efficient of antioxidant of catalytic has been since

CO-SCRDomain of a point.Some researchA lot of non-metallic certain of repair or with role can get GoodCO-SCRcatalytic. CoAndMnFor help can the promotingCu/Al₂O₃Of Low TemperatureCO-SCRActivity^[12]; QinSuch.^[14]Ni Co MnJoinMOFsMaterial before System of catalytic inCan. PromoteCO-SCRAnti-Activity.But a large number of non-metallicCO-SCRcatalytic get the studyButNon-metallic oxide catalyticCO-SCRof anti-Mechanism Research there is da zhengOff anti-species lack of. KantchevaSuch.^[13]Study pointed out that low temperature conditions underNitric acid or AdsorptionNO₂The formation of surface of acid species of generation andNOOxidation step lineCO-SCRAnti-very necessary.

The step analysis addCECatalytic onCO-SCRAnti-path and off anti-species of influenceDevelopment the different proportion Ce-co-o_xCatalyticCO-SCRAnti-AndCatalytic different ratio line of best catalytic Formula.According

XRD H₂-TPR BET,In situ diffuse reflectance the characterization fruit research.Ce-co-o_xCatalytic on theCO-SCRAnti-Mechanism.

1. Material and Methods

1.1 Co-precipitation of Different RatioCe-co-o_xCatalytic

System different proportionCe-co-o_xCatalyticPoints said to take a certain amount(Table1)OfCO (NO₃)₂In 6 H₂OAndCe (NO₃)₃In 6 H₂OSoluble in waterA,Again said the right amount of Carbonate(C₂H₁₁N₃O)Do, precipitate dissolve with waterB.WillBDripAChina,ToPH = 9Chi.Mixed2 hEmpress,Static20 min.After the anti-beam,Centrifuge thingsPH = 7Chi, 110Dry12 h 450Shili several small.

1.2 Catalysis, Characterization

1.2.1 XType of EmitterD8advance,Condition:Ding45kv,Flow, Set20mA,10 °/minLine, stroke.

1.2.2 Bi Surface Analysis(BET)Device Model The Autosorb-iQ2-MP,Condition: N₂.Atmosphere,Temperature573 KDown, line Desorption4 h,Again in469 KTemperature down,ToN₂Adsorption line.

1.2.3 H₂.Programmed hara (H₂-TPR) H₂-TPRAmbassador

Autochem 2920Server, row, Set.Specific step:Takeout50 mgPin,In300XiaN₂.Wei Li1 H,And then drop the temperature30,Then in10% H₂/HeThe temperature will be10/minFrom30Rose1000,TongTCDSignal Processing,DrawH₂-TPR.

1.2.4 Catalysis, originalOff-siteMechanism ResearchInspectionCO-SCRAnti-Mechanism,Yes, the adsorbed species,In situ adsorption was carried out.,Okay.NoAndCOAdsorption of.

NoAdsorption, step, as follows:InN₂Blow down400Li, pin1 H,InN₂Cool down and collect background.Cool30,Access included500x10⁶NoGas and Adsorption40 min.Then GuanNo, n₂Blowing30 min.At the end of each temperature point, Set10mimPost Collection.

COAdsorption, step, as follows:InN₂Blow down400Li, pin1 H,InN₂Cool down and collect background.Cool30,Access included2000x10⁶COGas and Adsorption40 min.Then GuanCO, n₂Blowing30 minAcquisition,Heat up to each temperature

Degrees point10mimHouce.

1.3 Catalytic Activity

This research mainly focuses on catalyticCO-SCRAnti-Activity, NoOxidation Performance, CoOxidation Performance,Fixed-bed counter, row-back.The whole Active valence system mainly includes:Mixed Gas,Canada anti and Tail Gas3.Part I.Active valence system, mainly constructed1.In the process of utilization,Flux flow, controlling the gas path.Re-gas mixing tank, inlet counter, tube.Various temperature points controlled by Tubular Furnace.Gas after catalytic reaction, enter,Each component in a fixed gas. CO-SCRActive priceChina,If no, Ming,Smoke Components: 5% O₂, 500x10⁶NoAnd1000x10⁶CO, n₂.Balance gas,Traffic90000 mL/min, ghsv = 200 h¹; No, no₂AndCOToyoy SwitzerlandECO physicsNitrogen oxide Analysis of the company(Model: CLD 822mh)And External Gas Analysis(Nicolet is50)Ding.At each temperature point, set the reverse40 min.

NoOxidation Performance,Model Flue Gas: 5% O₂, 500x10⁶No, n₂.Balance gas,Traffic90000 mL/min, ghsv = 200 h¹;Gas and gasNoAndNo₂.Set Method Ibid..

COOxidation Performance,Model Flue Gas: CO = 0.5%, O₂= 5%,UtilizationN₂.Balance,Traffic200 ml/min, Ghsv = 90000 H¹;Gas and gasCO, CO₂.Degrees by the gas phase color Ding.At each temperature point, set the reverse 30 min.

Among themNo, Co Rate as follows:

2. Guo Yu

2.1 ce, CoContentCe-co-o_xOfCO-SCREffect of Catalytic Activity

Such2.Shown,In additionCe (0.9)-Co (0.1)-O_xOutside,Other composite oxidesCO₃O₄.High Catalytic Activity.In addition, CEO₂.Catalytic activity is very low,In300Almost no activity before, 400 NoRate reached40%.DifferentCO, CEProportionCe-co-o_xThe activity.WhenCe-co-o_xCatalytic, Bi

9:1, In catalysis, there is a small amount CO, In 300 There is. 70% Of No Being Transformed, Ming CO Ce-co-ox Catalytic systems CO-SCR Play an important role, Co Probably. Ce-co-ox Major active centers in Catalysis. Ce-co-ox Catalytic Activity Along CO Increase in content, But Ce (0.7)-Co (0.3)-O_x And Ce (0.3)-Co (0.7)-O_x Catalysis, No Little difference in conversion rate, Show Ce (0.7)-Co (0.3)-O_x Empress, With CO One step increase in content, Activity is not clear, improve. Probably because CeO₂ Used as a catalyst for the dispersion of active sites.^[2-3], Thus CO Play a dispersion role, Co May be unevenly distributed in catalysis, No active improvement.

According to the literature, dow, In-Ag/CeO₂-γ-Al₂O₃ Catalytic in 400 NO Of rate to reach 80%, In 250 Only 40% NO Of Rate^[7]. Pt/W-Ce-Zr Catalytic in temperature 400

Only 15% Of NO Was^[8]. Cu-CeO_x Catalytic in 250 And 300 Points have 50% And 83% About NO Was^{9]}. The catalytic CO-SCR Activity or low temperature under activity are as this paper in Ce (0.3)-Co (0.7)-O_x Catalytic.

2.2 Catalytic Characterization

2.2.1 Than surface analysis CO₃O₄ (38.0 m²/G) Than surface CeO₂ (68.8 m²/G) Low much In CeO₂ In join CO₃O₄

Ce (0.3)-Co (0.7)-O_x Catalytic of than surface increase

(95.2 m²/G). Of Ce (0.3)-Co (0.7)-O_x Of CO-SCR Activity

Can see Ce (0.3)-Co (0.7)-O_x Catalytic of than Surface Catalytic of catalytic activity plays an important role of Role. CE And CO The composite can a rise than surface To make a of catalytic surface of activity a quantity increase.

2.2.2 X Shoot Diffraction Analysis 3 Of XRD Analysis fruit can see With precipitation Legal System CeO₂ Taste. CeO₂ Cubic crystal phase CO₃O₄ Taste. CO₃O₄ Crystal Phase Ce-co-ox Products Have typical CeO₂ Cubic stone structure of diffraction peak With CO Content increase CO₃O₄ Of kurtosis-by-. With CeO₂ The peak than oxide of peak-more And to high diffraction angle offset Show that CO May CeO₂ The crystal phase in formation SOLID SOLUTION^[15]. Solid Solution Structure of formation will make CeO₂ Students More more OF OXYGEN VACANCY And improve surface chemical adsorption oxygen of Ratio To oxygen mobility^[16].

2.2.3 H₂-TPR Analysis such 4 Shown in CeO₂ Catalytic have 2A yuan feng Points is because catalytic surface oxygen species of original (469), Lattice oxygen of original and CeO₂ To Ce₂O₃ Of (798)^[17-18]. CO₃O₄ Points in 323, 410 Have two Yuan feng Low temperature under the peak CO³ Ion CO² Related High temperature peak is due COO Metal CO^[19]. Ce (0.3)-Co (0.7)-O_x Catalytic in The first peak of ming zeng The catalytic of consumption queen.

2.2.4 Ce-co-ox Of CO And NO Oxidation activity CO Oxidation

Activity: Different Ratio catalytic CO Oxidation activity such 5 Shown in. 50

Only CO₃O₄ CO Oxidation table the certain of catalytic role.

With the temperature Of Of L High CO₃O₄ Ce (0.3)-Co (0.7)-O_x And

Ce (0.5)-Co (0.5)-O_x Catalytic CO Of rapid increase Which

CO₃O₄ And Ce (0.3)-Co (0.7)-O_x In 75 Yes 90% Of CO

Was Of And can in 100 ~ 200 Of temperature area keep 100%

CO Of Rate. And Ce (0.5)-Co (0.5)-O_x In 100 CO Of rate 90% More than however Ce (0.9)-Co (0.1)-O_x And Ce (0.7)-Co (0.3)-O_x Catalytic of activity improve slow In 150, Only 100% Of CO Of Rate. CeO₂ CO Of catalytic

Beginning hold in 40% The following. The can CO Is CO Oxidation of main

To Activity points. General CO Oxidation activity high can promote CO-SCR Activity. May is Ce (0.3)-Co (0.7)-O_x Catalytic CO-SCR Activity high reason one.

The absorption peak^[23] 1679¹ Which is the double-coordination VAs (Co²) Absorption

3

Peak 1380¹ Belongs Vs (COO) Absorption peak. Ce (0.3)-Co (0.7)-O_x Catalytic Phase in CO₃O₄ Phase In 2173 And 2119¹ The the new CO Adsorption species. 2A catalytic similar of is When temperature increase Carbonate kurtosis-by-weakened Until finally disappear. Can solution low temperature under CO Was adsorption formation carbonate species And high temperature under Some carbonate species may from catalytic on desorption or decomposition.

250 CO₃O₄ In 1679, 1538 1436, 135 1 cm¹ Carbonate species absorption peak disappear But Ce (0.3)-Co (0.7)-O_x Catalytic in

1679, 152 6 1432¹ Carbonate species absorption peak still there. Table

Ming Ce CO₃O₄. Increase the carbonate, qualitative. Above, Ce (0.3)-Co (0.7)-O_x Adsorption on Catalysis CO Species may be their CO-SCR Anti, performance CO₃O₄. Important reasons for catalytic upgrading.

No Adsorption: CO₃O₄. And Ce (0.3)-Co (0.7)-O_x Catalytic upper

No Adsorption, external absorption, 8. CO₃O₄. In 1625,

1535, 1438, 1278, 1193, 1008¹ Average absorption peak. Among them, 1625¹ Because after two, nitric acid^[22], 1535¹. Thanks to the chelating double nitric acid species, 1193¹ Double nitric acid species^[25-26], In 1438¹ Out of the shoulder, for the junction, nitric acid, 1278¹ Expressed Nitric Acid^[23], 1008¹ Presence of nitric acid species^[27]. But Ce (0.3)-Co (0.7)-O_x Catalysis, in 1559, 150 6, 1438, 123 7, 1010¹ Absorption peaks of different species, In 1559, 150 6 And 1237¹, It is the absorption peak of chelating double, nitric acid^[25-26]. As the temperature

rises, Kurtosis weakened, Indicates that it is catalyzed and the surface is not very fixed. In 1438¹ Out of the shoulder due to pick up Nitric acid. Xiang Yu Co_3O_4 . Come, Ce Temperature 300 Co_3O_4 In 1625, 153 5 1438, 127 8 1193, 100 8 cm^2 Of peaks disappear. But Ce (0.3)-Co (0.7)- O_x Catalytic in 350 1559, 123 7/1010¹ The peak still set Show that Ce Co_3O_4 Of the some nitric acid of qualitative. In CO-SCR Anti-Process Ce (0.3)-Co (0.7)- O_x Catalytic may have multiple NO Adsorption species involved in-. Ce (0.3)-Co (0.7)- O_x Catalytic on the CO-SCR Anti-Mechanism: By more than fruit can Ce (0.3)-Co (0.7)- O_x Catalytic on the NO_x Adsorption species geng ding And NO_x Set adsorption help NO Oxidation of Students. On the other hand Co_3O_4 Catalytic 300 More NO_x Adsorption species almost disappear Still table the good NO Oxidation activity Inference on both NO_x Adsorption species involved in NO Oxidation-Also gas NO And catalytic surface chemical adsorption oxygen of Role. Of CO Oxidation fruit and CO Adsorption can Co_3O_4 Catalytic on CO Oxidation main is chemical adsorption oxygen and gas CO Anti-. And Ce (0.3)-Co (0.7)- O_x Catalytic on in addition to carbonate species Have weak adsorption CO The existence Some species can more easy and NO_x Students anti-to the catalytic CO-SCR Activity improve. Co_3O_4 Catalytic CO Oxidation activity may be CO Direct was Oxidation Can participate in CO-SCR Anti-of the proportion Affect low temperature section CO-SCR Anti-Activity. Ce (0.3)-Co (0.7)- O_x Catalytic on main angry CO (Co (g)) Or adsorption CO (Co (AD)) And adsorption NO_x (Main is pick up two Nitric Acid (NO_A) And chelating double nitric acid Of (NO_B)) Anti. Specifically, Cheng inferred as follows:

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