# Investigation of convertation of carbon monoxide to carbon dioxide on the surface of mixed nano-catalyst in initial trimmed of modification of radiation

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**Abstract:**In this article, the conversion of CO to $CO_2$ was researched in the $A_2O_3$+CuO catalyst on the closed stream reactor which was refined initially in the radiation.Kinetic dependance on conversion was analyzed in predefied surface temperature and in partsial pressure of carbon-monooxide. During the surveythe surface temperature of catalyst increased steadily, while the conversion speed rises accordingly. Thus, the share of conversion increases from 43% to 60% in various concentrations of carbon-monooxide in the temperature range on T= 80-250$^oC$.

**Keywords:** air pollution, nano-catalyst, carbon monooxide, kinetic addictive, modification on radiation,ionization, $CO_2$,concentration, catalyst surface

## INTRODUCTION.



Industrial enterprises and traffic are considered as major air pollution sources. Nowadays, it is ecologically vital process to diminish hydrocarbon, nitrogen oxides, Carbon-monooxide and carbon-dioxide in the content of exhausted gases and solid particles as well as decontaminating harmful wastes. Rapid advancement of transport industry resulted with excessive number of cars in the roads in last 2-3 decades. Consequently, the concentration of GHG and other various toxic substances appeared to be risen around the globe, particularly precipitated air quality, which has engaged with several parameters. Those are depending of technical condition ofengines, the quality of utilized fuel, along with road infrastructure and stable dynamics of movement of vehicles[1].

Carbon-monooxide, nitrous oxides is the foremost toxic and dangerous gas amongst traffic pollutants.The amount of the emissions constitute of 85-97% of total emission volume in megacities, as well as in Baku so thatthetoxic gases of carbon-monooxide is about 7% of total pollutants (without catalytic-neutralization devices)[5].

It seems that one of the major issues that is required to treated the exhaust gases in the internal combustion ofengines is economically usefull and easy provision of catalyst neutralizer which is installing onthepipe lines ofexhaust of cars and is main technical method for lessening emissions. Although, traditional platinum base catalysts are meetsrequirements effectively, while this material is significantly costly and reserves are deplorable. Therefore, focusing on advancements on catalyst neutralizer that are based on relatively cheap and qualitative materials.

Currently, there are various catalytic neutralizers that are modified with CuO and those are applied in the Oil-Chemistry industry largely as active structure component, which are utilized in processes of neutralization, conversion, Oxidation, isomerization, dehydration and others[5].

## METHODOLOGY:

**The initial radioliz.** The mixture of catalyst of nano-Al2O3 + CuO which was done initial radioliz irradation in the device of Co-60 isotope at the room temperature and atmospheric air. There are weight of catalyst is m = 7.32 grams, nano-size d= 20-30 nm was taken in. The radiation was carried out at the air condition for a period of time = 17 hours in diferent dose of radiation gamma ray. The practices dose of kinetics from P = 5,0 to 17,0 kQy , has been done. We researced and identifaid the optimal dose is 1,7 kGy which was high CO-convertation level.. The active

centers of catalyst surface and the quantity of elements concentrated is controlling by spectroscopy of SEM (Scanning Electron Microscope, Zeiss, SIGMA / VP).Discussion and results

The research work was conductedin the quartz reactor installed in the cycle system (d=10 mm,h=1 m) where was controlled speed of air stream, the temperature of surface of catalyst and change of concentration of carbon-monooxide in air mixture . The kineticsof conversion of carbon-monooxide to carbon-dioxide in different temperature has been investigated, while air& CO mixture (various ratios) passes through the surface of catalyst in different temperature. The consentration ofcarbon monooxide, carbon dioxide on the stream air mixturewereanalyzed at "Gasochrome 3101" and "Agilent Technologies 7890A GC" devices at J&W 113-4332,260 C, 30 m x 320 µm x 0 µm column[3]

Air compressor is used to circulate the mixed air in the line, while the speed of gases passing through system is controlled by gas speedometer. The parameters of H=10-15 sm height and m = 8-10 gr weightis installed in the quartz reactor, while the inlet and outlet are closed by means of fiberglass.The temperature of catalyst is controlled byAl-Cr thermo-pair- installed on thesurface of reactor. The reactor is covered by heat isolating material to keep the temperature stable. The ratio of $N(CO)/N(O_2)=1\div5\%$ is to be controlling due to proper conversion process.5 liter flask is used to provide oxygen and$N(CO) =10^{18}$ molec./m carbon monooxide is added to that volume.

At the end of cycle the reactor is cleaned, while the next phase is developed.

The oxidation process of carbon-monooxide to carbon-dioxide on the nano-catalyst surface of Al2O3+CuO is made initial modification of radiation has been investigated in closed stream reactor. The dependence of partial pressure of the conversion of carbon-monooxide on the surface of nano-catalyst of Aluminium 3 oxides with modification of nano copper-oxide is shown in the figure 1. The experimental results that is shown on the graphics curve where the speed of conversion is increase on lineally PCO□ 20 mm. Hg, in the interval of ΔPCO= 14÷35 mm.Hg where the speed of reaction is stable depending of pressure. The conversion process is effectively in the low PCO□14 mm. Hg partsial pressure of carbon-monooxide in the gas mixture, in the estimated data of PCO□14 mm.Hg the excess pressure have not of conversion [5].



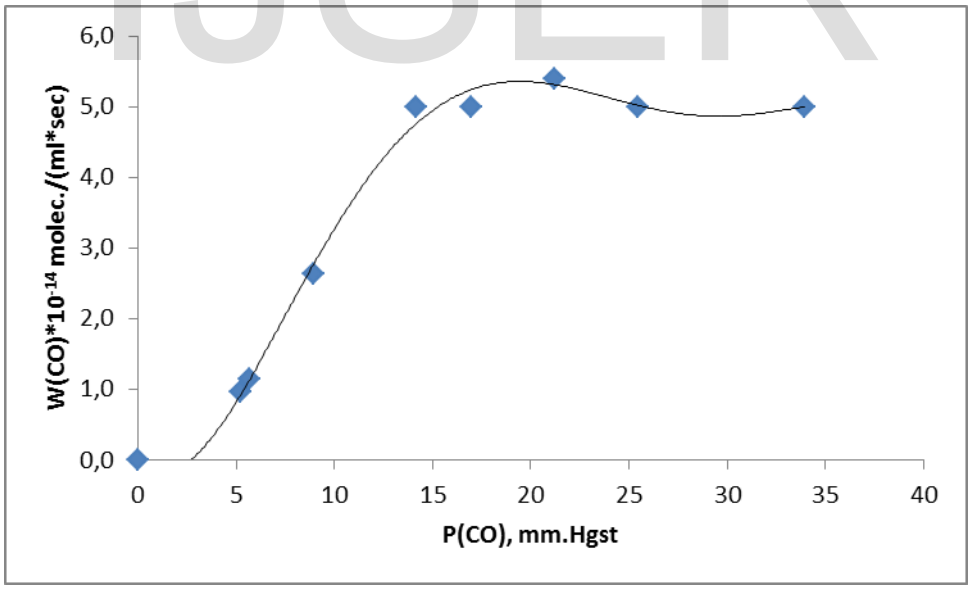


**Figure 1.** The dependence of partial pressure($P_{CO}$, mm.Hg.)of carbon-monooxide($W_{co}$,*$10^{-14}$ molec./($sm^3$*sec))of the conversion speed of carbon-monooxide on the surface of nano-catalyst (τ=15 min., V=30 l/min. $m_{Al2O3+CuO}$=7.32 gr.)

The conversion speed is stable by the data ($P_{CO}$,mm Hg) of partial pressureof carbon-monooxide as shown(see figure 1) while is need to be researchthe temperature depending of the conversion rate in this interval. The depending of the temperature of theconversion of concentration of gas mixture on the surface of nano-catalyst inthis interval (P(CO)=5.6 mm.Hg) 0.7% has been shown in the figure2

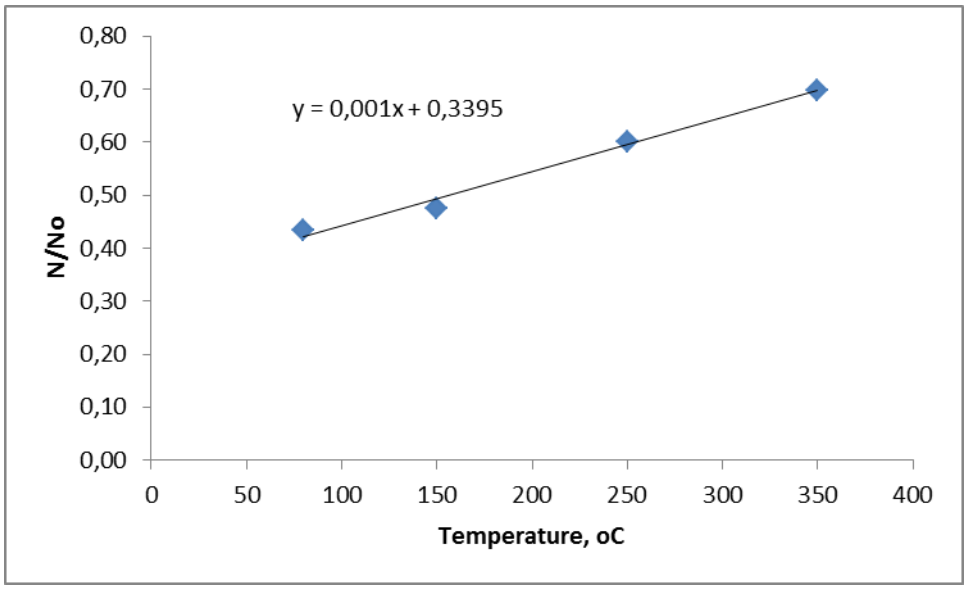


**Figure 2**. The temperature dependence on the conversion of carbon monooxide on the catalyst surface(τ=15 min., P(CO)=5.6 mm.Hg, V=30 l/min. N-$Al_2O_3$+CuO=7.32 gr.).

As shown on the graphics when the temperature of nano catalyst surface is increase as the conversion rate of concentration of gas mixture isincreasing$\frac{\eta_{350}}{\eta_{80}} = 1.62$time. The results is confirm thatwhen the temperature of system is increasing theintensity of contact oncatalyst surface and gas mixture increasing too while creation of active centers by thetype of anion at the results of primary irradiation to beactivatingin next phase of oxidation processes while the selectivity of nano-catalyst is over 90%. The investigation of kinetic of the convertation of different concentration of carbon-monooxide at different intervals of temperature is shown at the figure 3 and 4.

The kinetic dependence on decreaseof carbon-monooxide, is prepared in differentmixture concentration(∆N=(19.98÷81.0)*$10^{16}$ molek/ml) in the pressure ofatmospheric weather (P=0.102 Mpa)show thatthe speed of oxidation process is depending ofconcentration of substanceand the temperature on catalyst surface.The investigation conducted in low and medium temperature intervals (∆T=80÷350$^oC$) which is appropriate to the temperature of exhaust gases in exit pipe.

When the temperature of process is increasing,the convertation rate increase too while, the reaction of convertation take in more rapidly as shown by the figure. So that, the convertation of carbon-monooxide to carbon-dioxide in different mixture is over 43% at T=80$^oC$,while at T=250$^oC$ over 60%.Proverly the convertation speed processes to be at $W80_{oC}$=0.96, $W250_{oC}$=5.4*$10^{14}$ molek./(sm3*sec). If the temperature of system is increasing more, the process take inback while decomposition go on more rapidly

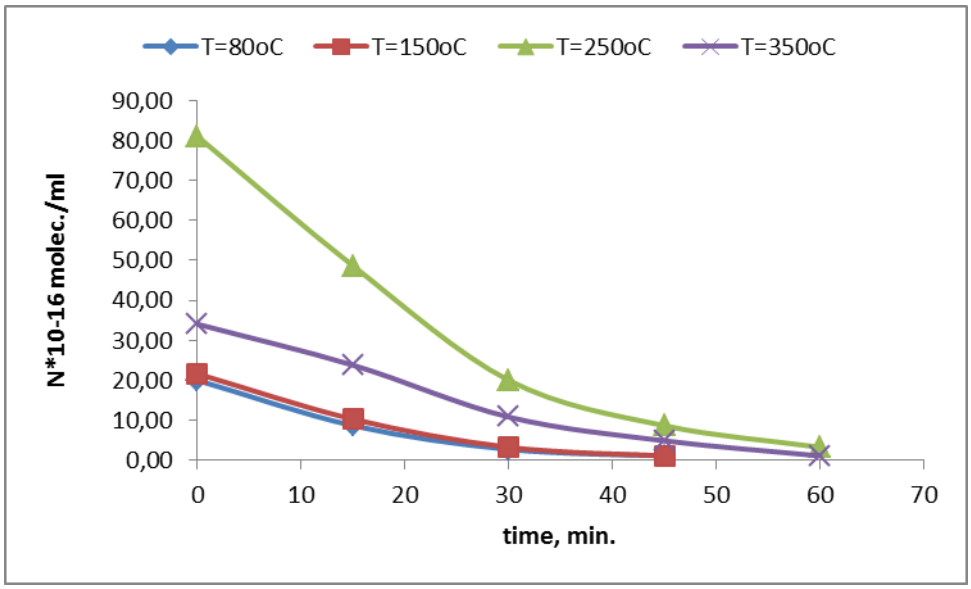


**Figure 3.** The kinetic dependence on convertation of carbon-monooxide of different concentration on the catalyst surface, refined initiallymodification of radiation in different temperature.

The kinetic depending of decrease of carbon-monooxide ($\frac{\eta_N}{\eta_{No}}$)on the surface of$A_2O_3$+CuO mixture catalyst, which was refined initially under the radiation at different temperature($\Delta$T=80÷350$^o$C) which is shown at the figure 4.

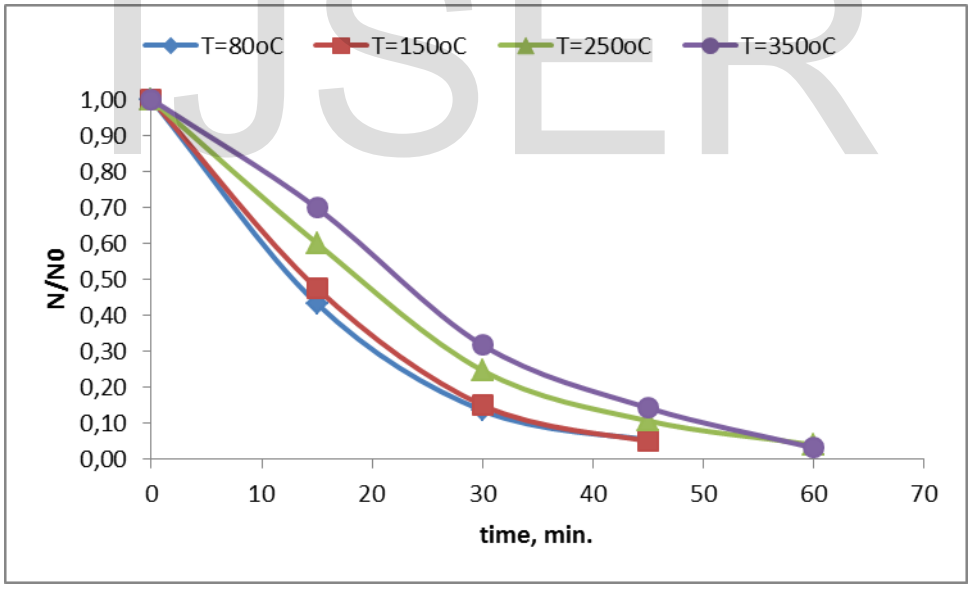


**Figure 4.** The kinetic depending of the convertation rate (N/No)of carbon-monooxide, refined initially under the radiation in different temperature (V=30 litr/min. $m_{Al2O3+CuO}$=7.32 gr.).

As shown by the figure that the high percent of convertation processes at low temperature explains so that the oxidation procecc take inlineally while the main processes not take of yet. While, the convertation percent is ((N/No)*100%) 53% during $\tau$=15 minutesat T=80$^o$C, while decrease is over 30% at T=350$^o$C, which is confirm that if the temperature is increase the process is go on at low.

The processes of mechanizm carried out on the surface of catalyst could be explain shortly:

1. First of all, the carbon-monooxide and oxigen in thegas mixture are absorbed on thecatalyst surface

2. At the final results the oxidation –reduction reaction on the surface of catalyst is increase by the cause of anion centers creation in the border .
   As a result,the enerji ( the quantity of enerjy of valent zone ) is transferto the surfacewhere,in this casethe ionization ofmolecules of oxigen by absorbed on the surface isincrease the quantity of concentration of anion(O^-)centers at the border of gas mixture -catalyst(see formule of 1). İn the sysem of the created of electron-hole centers on the surface and volume ofthe absorbed enerji by the catalyst asconductivity and valent zone in initial trimmed of modification of radiation in mixture gas(gas mixture +catalyst)

$$CO + O^- \rightarrow CO_2^- \rightarrow CO_2 + e^- \qquad (1)$$

   Continiuesly, the anions$CO_2^-$discargeas joining to the electrons, was outing from valent zonecreating on the surface,in the next phase where, at the end they are desorbtion as electroneytralization molekules by the catalyst surface.

The above description fact show that theconvertation of carbon-monooxide to carbon-dioxide isrealize efficientlyat sufficient low temperature (80-250$^o$C). At the high intervals of temperature the thermalandradiation yield are alignment therefore it is not effective to research in high temperature.

## RESULTS:

1. It is determined that the conversion speed is stable at the interval of parcial pressure ∆PCO=1÷14 mm.Hg of carbon-monooxide in one atmospheric pressure of gas mixture on $Al_2O_3$+CuOnano-catalyst surface.The convertation rate was increasing is$\frac{\eta_{350}}{\eta_{80}} = 1.62$ time, while the temperature has increasing in nano-catalyst surface in this intervals.

2. The modification of Gamma ray to the catalyst is influence the activattion on the surface of catalyst by increase of convertation of carbon- monooxide. The conversion reaction is take of more rapidly and the rate of conversion is increase on the mixture Al2O3+CuO catalyst surface. Thus, the percent of convertation of carbon-mono-oxide to carbon-dioxide in diferent concentration are increase from 18 to 22 % at the temperature from 80 to 250oC temperature appreprіate to the exhaust gas of car engines .



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