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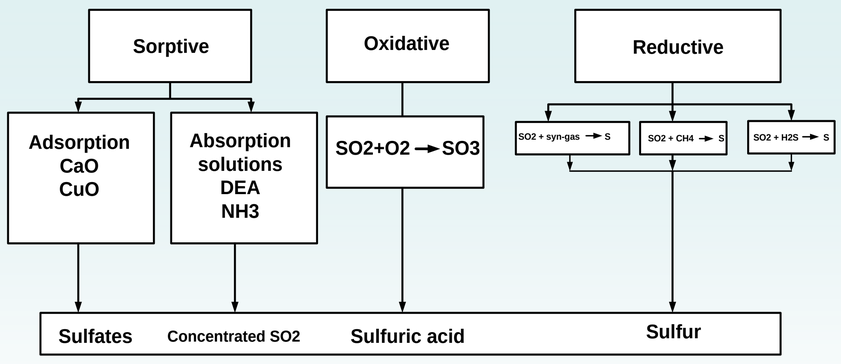
Boreskov Institute of Catalysis

The Polar Division of MMC Norilsk Nickel

New catalysts and advanced technology for catalytic reduction of sulfur dioxide from emissions of nonferrous smelters

Zinfer Ismagilov[a], Sergei Khairulin[a], Svetlana Yashnik[a], Valentin Parmon[a], Igor Ilyukhin[b]
a *Boreskov Institute of Catalysis, Novosibirsk, 630090, Russia*
b *The Polar Division of MMC Norilsk Nickel. Norilsk, Russia*

Modern methods of SO_2 abatement



Catalytic methods leading to formation of elementary sulfur are the most prospective ways for substantial reduction of sulfur dioxide emissions.
Sulfur is non-toxic product, no problems with transportation and storage
High demand of world market in sulfur.
Current price is over 600 $ per metric tone

The enterprises of non-ferrous metallurgy are the main factor of environment pollution with sulfur dioxide

SO_2 is resulting from the roasting of non-ferrous ores

Typical emissions:
ca. 1 000 000 tons of SO_2 per year (Polar Division of Open Joint Stock Company Mining and Metallurgical Company Norilsk Nickel - Russia)
ca. 500 000 tons of SO_2 per year (Balkhash Mining and Metallurgical Company – Republic of Kazakhstan)

The requirements to the catalysts to be developed:
High temperature reduction of SO_2 with methane
$SO_2 + CH_4 \Leftrightarrow S\ (H_2S) + H_2O + CO_2$
High thermal stability (the range of operating temperatures is 700-960°C)
Resistance to coking

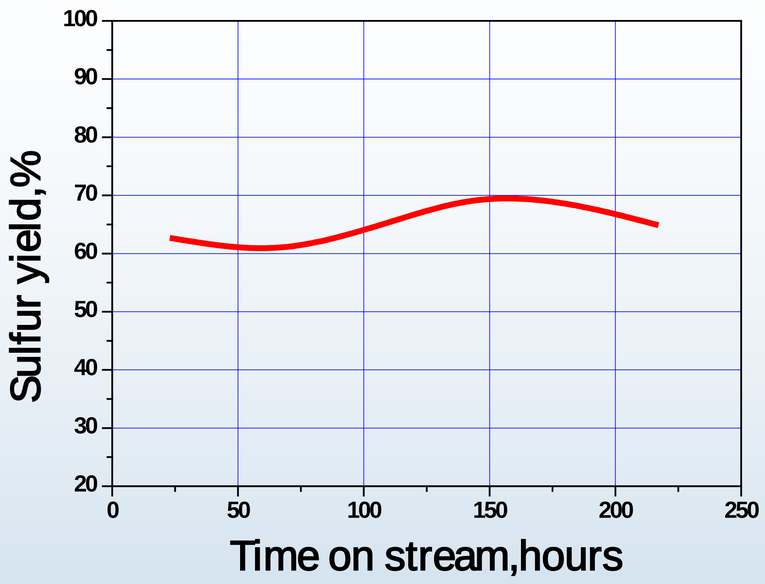
Low temperature reduction of SO_2 with syn-gas
$SO_2 + H_2(CO) \Leftrightarrow S + H_2O(CO_2)$
High selectivity to sulfur
Suppression of formation of side products carbon disulfide, carbon sulfide oxide.

Laboratory set-up at BIC

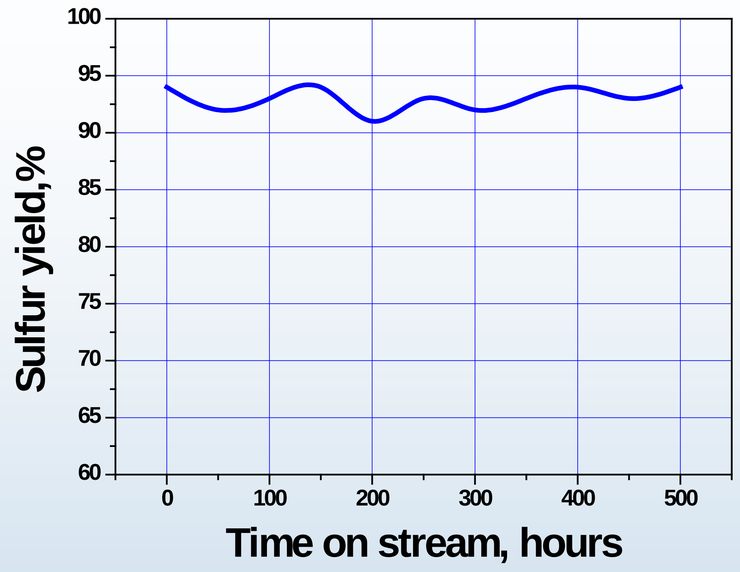
Testing the catalysts performance in BIC pilot plant

Pilot plant for testing the catalysts under realistic conditions

MAIN RESULTS OF PILOT TESTS



High temperature reduction of SO_2 with methane
***Temperature*: 910 ÷ 965°C,**
supported oxide catalyst,
GHSV = 1250 ÷1320 h^{-1} ■



Low temperature reduction of SO_2 with syn-gas
***Temperature*: 400 ÷ 500°C,**
supported oxide catalyst,
GHSV = 1450 h^{-1}.

Comparative analysis of process versions

PROCESS CONDITIONS	SO_2 REDUCTION WITH METHANE	SO_2 REDUCTION WITH SYN-GAS
Temperature,°C	910 ÷ 960	400 ÷ 600
Sulfur yield,%	60-65	> 80

to high prospects of low-temperature sulfur dioxide reduction with syn-gas and its substantial advantages ov