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Tutorial N°3. Production of Sulfuric Acid

Exercice 1

Let's assume we have a gas entering the converter with 20 moles of SO_2 and 10 moles of O_2. After the reaction, the gas exiting the converter contains 12 moles of SO_2. We want to calculate the conversion rate of sulfur dioxide (SO_2) to sulfur trioxide (SO_3).

Exercice 2

In a furnace, pure sulfur is burned with the addition of air in a ratio of 35% of the required amount to convert sulfur completely into sulfur dioxide (SO_2). In reality, 98% of the sulfur is converted into SO_2 and 2% into sulfur trioxide (SO_3). Calculate the volumetric composition of the gas that exits the furnace.

Composition of air : 21% oxygen (O_2) and 79% nitrogen (N_2).

Exercice 3

We aim to produce sulfuric acid from pyrite (FeS_2) using the contact process. The roasting of pyrite is carried out in a furnace with an excess of air. The gas exiting the furnace, after dust removal and drying, is added with excess air to reach the volumetric composition (SO_2: 12%, O_2: 10%, N_2: 78%). The gas is then heated to 425°C and enters an oxidation reactor operating at atmospheric pressure, consisting of 4 catalytic beds (catalyst: vanadium oxide V_2O_5 with a promoter). After passing through the 4 catalyst beds, 98% of the SO_2 is converted into SO_3. The formed SO_3 is almost completely absorbed in an absorption tower by sulfuric acid to produce oleum.