# Process for the controlled decomposition of peroxo compounds

## Description

The present disclosure relates to a method for manufacturing CO and/or $CO_2$ from a peroxo compound and to a method for the controlled decomposition, removal or destruction of peroxo compounds, especially inorganic peroxo compounds comprising peroxides containing sulfur, phosphorpous, nitrogen, boron and / or hydrogen peroxide, wherein a peroxo compound is reacted with an alkane, especially methane and $SO_3$ in a way that $CO_2$ and/or CO are formed as the main decomposition products (instead of oxygen).

The present disclosure furthermore relates to the use of an alkane, especially methane, and the use of sulfur trioxide in the decomposition of peroxo compounds, especially peroxo compounds containing sulfur, phosphorpous, nitrogen, boron and / or hydrogen peroxide or mixtures thereof.

The present disclosure also relates to a method for manufacturing $CO_2$ and/or CO from peroxo compounds.

In an aspect, there is provided a method for the decomposition, removal or destruction of at least one peroxo compound, wherein a peroxo compound, especially a peroxo compound comprising sulfur, phosphor, nitrogen, boron and/or hydrogen peroxide, is contacted, preferably in acidic medium, preferably free of water, with an alkane and $SO_3$ .

In another aspect, there is provided the use of an alkane, preferably methane, and sulfur trioxide for decomposing peroxo compounds, preferably a peroxo compound comprising sulfur, phosphor, nitrogen, boron and/or hydrogen peroxide.

In another aspect, there is provided a method for manufacturing $CO_2$ and/or CO from a peroxo compound, wherein a peroxo compound, preferably a peroxo compound comprising sulfur, phosphor, nitrogen, boron and/or hydrogen peroxide, is contacted with an alkane, preferably methane, and $SO_3$, preferably over a large surface area in the reaction vessel.

### Peroxo compounds (general)

Peroxides or peroxo compounds of the general type R-OO-R, are widely used e.g. as catalysts for chemical reactions or as cleaning agents in e.g. water treatment. According to Ullmanns encyclopedia of industrial chemistry, (DOI 10.1002/14356007.a19_177.pub2), Peroxo compounds

include hydrogen peroxide and substances derived from hydrogen peroxide by substitution of one or both hydrogen atoms by a metal or a nonmetal such as sulfur, boron, nitrogen, or phosphorous. Also hyperoxides (MO2, with M being e. g. Na, K, Li, ….), $H_2O_2$ adduct compounds (e.g., sodium carbonate peroxohydrate), and the inorganic ozonides (MIO3, with M being e. g. Na, K, Li, ….) are summarized under this term. (Whereas the prefix peroxo is, according to the IUPAC nomenclature, used for inorganic compounds, the prefix peroxy is used for organic compounds. In this text, the terms “peroxo” and “peroxy” are used synonymously.)

The O-O bonding strength in peroxo compounds is rather low (~209 kJ/mol), so all peroxo compounds can be regarded as powerful oxidation agents with strong oxidizing properties. This is due to the fact that the oxygen atom in the peroxo compounds is present in the unstable +1 oxidation state. However, depending on the co-reactant,  reaction conditions and solvent (protic, aprotic, acidic, superacidic) peroxo compounds, especially Hydrogen peroxide can react as both