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AP42 Section:	9.2.1
Background Ch	2
Reference:	17
Title:	I. R. Kennedy, <i>Acid Soil and Acid Rain</i> , Research Studies Press LTD, England, 1988.

Sect. 2
#17

RELATED APPLIED FIELDS

and Functions

and Sulphur Cycling

Acid Soil and Acid Rain

The Impact on the
Environment of Nitrogen
and Sulphur Cycling

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RESEARCH STUDIES PRESS LTD.

Letchworth, Hertfordshire, England

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chemistry concerned is difficult but in the upper atmosphere probably involves free radical formation:



[8.23]

as part of an overall reaction:



[8.24]

Some aspects of these atmospheric reactions of sulphur have been discussed by Manahan (1975).

8.2.1. Coal burning

The primary source of oxidized sulphur from human activity is by the burning of coal. Much of the world's coal used for energy purposes contains more than two per cent of sulphur. About half of this is present as pyrite (FeS_2) and the remainder is of organic nature. Sulphur dioxide is produced readily on burning such materials in reactions such as:



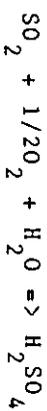
[8.25]

or reactions similar to [8.24]. Relatively little of the sulphur leaves the smoke stacks as sulphur trioxide (SO_3), higher temperatures or catalysts being required to effect its formation.

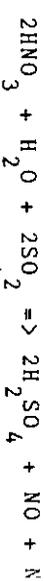
8.2.2. Reactions of sulphur dioxide in the atmosphere

Much of the sulphur dioxide in the atmosphere is further oxidized to sulphur trioxide and hence sulphuric acid, by a complex series of reactions of somewhat uncertain nature. These products, as ammonium salts, may be very conspicuous in forming a colloidal haze of aerosol nature

(Charlson et al., 1974). Normally, the of sulphur dioxide to sulphur trioxide measure (Haagen-Smit and Wayne, 1961) sunlight in a humid atmosphere, approximate conversion per hour has been observed (



Apparently, a photochemical excitati general, the occurrence of other including NO_x is thought to increase conversion (Anonymous, 1983). The Lea has for many centuries been a manufacturing sulphuric acid. Here sulphur dioxide and the fum tanks to react with nitric acid:

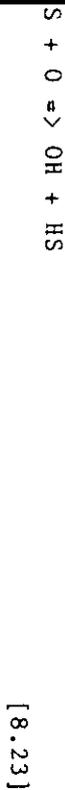


The nitric oxide is recovered in concentrated acid in a separate chamber (Tisdale seems probable that related processes atmospheric conversions, catalyzed by another process for sulphuric acid platinum or palladium metal catalysts conversion to sulphur trioxide, and pollutants containing metals have been implicated sulphuric acid in air.

8.2.3. Smelting of pyrite ores

The smelting of pyrite for iron, in which is initially oxidized to sulphur dioxide

istry concerned is difficult but in the upper sphere probably involves free radical formation:



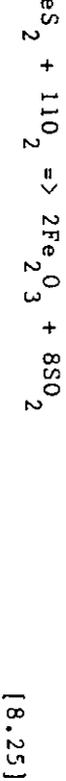
part of an overall reaction:



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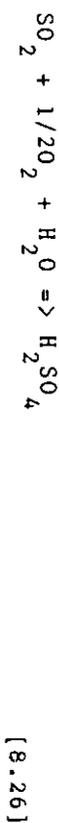


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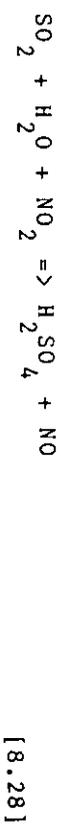
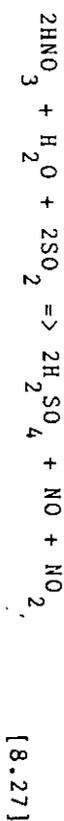
2. Reactions of sulphur dioxide in the atmosphere

of the sulphur dioxide in the atmosphere is further oxidized to sulphur trioxide and hence sulphuric acid, by a complex series of reactions of somewhat uncertain nature. These products, as ammonium salts, may be very conspicuous in forming a colloidal haze of aerosol nature

(Charlson et al., 1974). Normally, the rate of conversion of sulphur dioxide to sulphur trioxide is too slow to measure (Haagen-Smit and Wayne, 1968). However, in sunlight in a humid atmosphere, approximately 0.1 per cent conversion per hour has been observed (Bufalini, 1971):



Apparently, a photochemical excitation is involved. In general, the occurrence of other pollutant species including NO_x is thought to increase the rate of conversion (Anonymous, 1983). The lead chamber process has for many centuries been a common means of manufacturing sulphuric acid. Here sulphur is burnt to produce sulphur dioxide and the fumes passed into lead tanks to react with nitric acid:



The nitric oxide is recovered in concentrated sulphuric acid in a separate chamber (Tisdale et al., 1985). It seems probable that related processes are involved in atmospheric conversions, catalyzed by nitrogen oxides. Another process for sulphuric acid manufacture uses platinum or palladium metal catalysts to effect the conversion to sulphur trioxide, and polluting particulates containing metals have been implicated in the formation of sulphuric acid in air.

8.2.3. Smelting of pyrite ores

The smelting of pyrite for iron, in which ferrous sulphide is initially oxidized to sulphur dioxide and ferric oxide