

6. In general, the rate expressions for catalytic oxidation to form sulfuric acid are not well-established.

2.3.4.3 S(IV) - Carbon Black -O₂ - H₂O-- The catalysis of the oxidation of dissolved SO₂ by carbon particles suspended in the water has been studied by Chang et al. (1979) and by Eatough et al (1979). It was found by Chang et al. (1979) that the oxidation rate of dissolved SO₂ species was:

$$-\frac{d[S(IV)]}{dt} = k[C][O_2]^{0.69}[S(IV)]^0 \exp.(-E_a/RT) \quad (2-32)$$

with an activation energy of $E_a = 11.7$ kcal/mol over the pH range of 1.45 to 7.5 for the carbon studied, which was Nuchar-190. (The investigators demonstrated that Nuchar-190 behaved similarly to soot from acetylene and natural gas flames.) An average value of $k = 1.17 \times 10^5 \text{ mol}^{0.3} \times \text{liter}^{0.7}/\text{g-sec}$ was reported. The kinetics have been interpreted in terms of the rate-limiting step being the formation of an activated complex between molecular oxygen and the carbon surface (Chang et al., 1979; Eatough et al. 1979).

Chang et al. (1979) have estimated that for 10 ug of their fine carbon soot suspended in 0.05 g of liquid water and dispersed in 1 m³ of air, the atmospheric sulfate production would be 1 ug/hr. Heavy hydrocarbons are adsorbed on the surfaces of atmospheric soots and may inhibit the carbon-surface catalyzed oxidation of dissolved SO₂. At this time, it remains to be demonstrated that the laboratory soots used by Chang et al. (1979) correspond to those present in the