

homogeneous gas reaction oxidation pathways are being studied (Su et al., 1980), but certainly the role of heterogeneous and liquid phase  $\text{SO}_2$  oxidation pathways should not be overlooked in attempts to resolve this discrepancy.

Summary. The status of our knowledge of  $\text{SO}_2$  gas-phase oxidation in the troposphere is:

1. HO radicals appear to dominate the gas-phase oxidation of  $\text{SO}_2$  in the clean troposphere. A typical rate is on the order of  $1.5\% \text{ h}^{-1}$  at noon during July at mid-northern latitudes.
2. HO radical accounts for about  $1.2\% \text{ h}^{-1}$  of the  $\text{SO}_2$  oxidation in the polluted troposphere. The combined contribution of  $\text{HO}_2$  and  $\text{CH}_3\text{O}_2$  radical reactions may result in a greater oxidation rate of  $\text{SO}_2$ , but their rate constants are not well established.

#### Solution-Phase Chemical Reactions of Sulfur Dioxide

The knowledge of the reactions of the aqueous  $\text{SO}_2 \cdot \text{H}_2\text{O} - \text{HSO}_3^-$  and  $\text{SO}_3^{2-}$  system is important to understanding the processes of  $\text{H}_2\text{SO}_4$  formation in tropospheric particles, mists, fogs and rain. This section reviews the oxidation reaction of dissolved  $\text{SO}_2$  species, including the auto-oxidation, metal-ion catalyzed oxidation, carbon catalyzed oxidation, and reactions with the dissolved oxidants  $\text{NO}_2$ ,  $\text{O}_3$ , and  $\text{H}_2\text{O}_2$ .

The state of knowledge of aqueous oxidation rates of dissolved  $\text{SO}_2$ ,  $\text{HSO}_3^-$ , and  $\text{SO}_3^{2-}$  is inadequate for simple systems and is extremely poor (or non-existent) for complex systems that include dissolved nitrogen and carbon compounds. Unfortunately, most of the studies are not definitive because the investigators: (1) did not provide sufficient descriptions of experimental procedure (especially the purification of the water and reagents), (2) did not select a proper reactor design to eliminate mass transfer limitations, and (3) worked at concentration levels that were orders of magnitude greater than possible for ambient atmospheric aqueous systems. Trace quantities (at the part-per-billion level) of catalytic metal ions are capable of enhancing the