11 Summary

Stone and other surfaces are still corroded by dry-deposited sulphur dioxide, although the present concentration is in the lower ppbv range. In this work experiments were conducted to separate and assign the different resistances during the deposition process at concentrations of SO_2 found in the environment today. To compare surfaces with different reactivities, the varying uptake and the resulting SO_2 concentration over the surface has to be concerned. Therefore a test chamber has been developed that allows the SO_2 concentration to keep constant independent of the SO_2 uptake. Different stones and passive samplers were investigated in this chamber, scanning a wide range of humidity and concentration that hasn't been studied before. The passive sampler were also studied in a closed wind tunnel with an sulphur dioxide containing atmosphere.

It has been found that the deposition velocity is increasing with decreasing SO_2 concentration for all stone types. The calcareous Ihrlerstein sandstone shows the greatest sensivity to acid attack, the observed deposition velocities covered a range from 2,6 cm/s at 8 ppbv SO_2 and 95% r.h. to 0,3 cm/s at 200 ppbv SO_2 and 45% r.h. The values are showing that the v_d value of this stone is not only dependent on the concentration but also on the humidity. The deposition on the two silicate stone types is considerably lower and was not affected by the moisture. Obernkirchen sandstone (nearly pure silicate) shows a deposition velocity between 0,07 cm/s at 200 ppbv and 0,3 cm/s at 8 ppbv, Sand sandstone (up to 10% feldspar and clay minerals) between 0,14 cm/s and 0,6 cm/s.

Investigation of passive samplers have been performed too. It has been found, that they are a perfect sink for sulphur dioxide and therefore they can be used as reference system for aerodynamic resistances. They absorbed the largest amount of all studied surfaces and they show the highest deposition velocity. They are not affected by concentration and by humidity, but turbulence has a direct influence, caused for instance by wind. The independence of humidity is limited to that range found in field measurements and is also limited by organic compounds (such as glycerol or triethanolamine) in the impregnation of the samplers.

The deposition velocity on the passive samplers in the wind tunnel covered the range from 1 to 2,5 cm/s, while the wind speed varies from 2 to 6 m/s. That leads to a correlation between the aerodynamic resistances $R_a + R_b$ and the wind speed under turbulent conditions according to equation 10-1, where $k_1 = 1{,}77$.

All findings are suitable to suspend field measurements conducted by this workgroup and other reported results. They allow a further modelling with the aim to predict the future damage of cultural heritage by acid components.