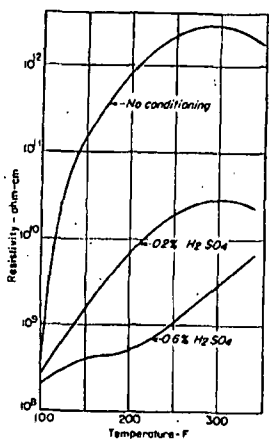
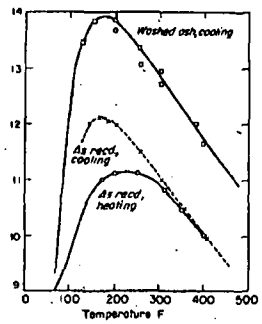
TECHNICAL BRIEFS

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1 Heating destroys flyash conductivity indicating water is not sole factor

2 Sulfuric acid or fume proves a major conditioning factor in precipitating ash

Clean Air Studies Show Gains

Electrical Resistivity of Fly Ash. *By H J White, Research Corp.*

Electrostatic precipitation has long been accepted as a standard method of dealing with air pollution from industrial sources. These sources usually involve large gas-flow rates, high particle concentrations, high gas temperatures and other difficult operating conditions. This paper deals with an important phase of research in one of the largest fields of electrostatic precipitation—the removal of fly ash from pulverized-coal-fired boilers in the power generation industry.

The successful application of precipitators in the fly ash field over a period of many years and under conditions of constantly increasing gas flow and efficiency requirements, together with the trend toward the burning of poorer-grade coals, has required the solution of many difficult problems. Electrical resistivity of fly ash was chosen as the subject of this paper because it provides a good illustration of the advances which have been achieved in recent years through the application of fundamental research.

Fly ash is a complex mixture of inorganic compounds similar in characteristics to certain vitreous insulating materials which, in the pure state, have high electrical resistivities of the order of 10^{14} to 10^{15} ohm-cm. The conductivity of fly ash for temperatures below about 550 F depends basically on the presence of moisture and of certain chemical impurities in the gas which are adsorbed on the particles. The influence of varying amounts of these chemical conditioning substances is indicated by the fact that a wide range of fly ash resistivity is encountered in practice, ranging between about 10^6 and 10^{14} ohm-cm for measurements made in the laboratory, and between about 10^8 and 10^{13} ohm-cm for field measurements.

Research of the nature and identity of the chemical substances specifically responsible for conductivity in fly ash was initiated in the author's company laboratory in 1946. Prior to this time a large amount of laboratory and field information regarding fly ash conductivity had been accumulated and qualitative explanations for some of the phenomena involved had been advanced. However, the fundamental question regarding the nature and identity of the active conditioning substance or substances was completely unanswered, as were of course contingent questions regarding the amount of the conditioning substance required and the conditions and factors influencing its presence in boiler gases.

Fig. 1 reveals the rather striking result that the resistivity values measured for the cooling portion of the resistivity-temperature cycle are substantially higher than those obtained for the heating portion—strong evidence that some volatile substance other than water vapor is profoundly influencing conductivity. Isolation of this natural conditioning substance was one of the major objectives of the research.

Once the fact was established that the conductivity factor or agent is water soluble, the problem was reduced to that of identifying the effective chemical substance. Chemical analysis of the filtrates obtained from washing the various ashes showed that they were comprised primarily of sulfate and lime, with small quantities of alkali also present. It therefore appeared that the conditioning effect was caused either by the presence of the sulfate or the lime, with the former the most probable because of the previously observed effects of strong heating in destroying the conductivity of the ash.

Experiments provide conclusive evidence of the strong conditioning effect of sulphuric acid or SO_3 fume on fly ash under actual precipitator conditions, Fig. 2. The classical conditioning effects observed were: (1) The resistivity of the ash was lowered substantially by using only a fraction of a percent of acid, (2) this reduction in resistivity permitted operation of the test precipitator at much higher voltages without back corona or sparking, (3) visual observations showed that the efficiency of the precipitator increased greatly when the conditioning agent was used. *APCA Paper. No number.*

Unique Aspects of Air Pollution in Los Angeles. *By F E Littman and P L Magill, Stanford Research Institute.*

By most standards Los Angeles is a "clean" city. There is no soot or fly-ash, the dust fall is below average and the SO_3 concentrations are negligible. And yet, Los Angeles "smog" is one of the



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