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A.S.M.E ANNUAL MEETING

This year's Annual Meeting of the American Society of Mechanical Engineers, with a total registration of nearly 2500 was held at the Hotel Astor, New York, December 2 to 6. The program included forty-five technical sessions of which a substantial number dealt directly or indirectly with the production of power. Among these were papers on silica removal from feedwater, boiler design and circulation, furnaces, boiler casings, stoker fuel beds, fluid temperature of ash, steam piping, condenser tubes, flue dust recovery, turbine lubrication and marine power plants. Digests of some of these papers and their discussions follow:

Methods of Silica Removal

Removal of silica from boiler waters formed the subject of three papers at the Monday evening session on "Boiler Feedwater Studies."

Harold Farmer, Chief Chemist of the Philadelphia Electric Company, in a paper on "Silica in High-Pressure Boiler Waters," observed that, in general, silica had not given serious trouble at steam pressures below 600 lb. or else could be effectively controlled. However, with high steam pressures around 1200 lb, and particularly with high rates of heat input, there have been many tube failures in which silica appears to have played a significant part.

It has been suggested that in some cases high rates of evaporation have disturbed the circulation and resulted in starvation in certain tubes, thus permitting deposition of soluble salts, including silica, on the dry areas. When these areas are again wetted the soluble salts are dissolved, but during the dry period the silica may have undergone a change in structure and ceased to be soluble. With repetition of such cycles the silica deposit will build up and cause overheating of the tube with resulting ultimate failure. Some such failures have been manifested by blistering.

In other cases, instead of a blister, a small hole surrounded by hard silica scale has been noted. Some have attributed this type of failure primarily to starvation with accompanying silica deposits and ultimate failure due to small pieces of this scale breaking away and the exposed metal trying to absorb too much heat.

Even with good condensate feedwater, assuming the total solids to be 1 ppm, the water may contain 0.1 ppm of silica. While this may seem insignificant, many present-day high-pressure boilers evaporate their own volume of water five times in one hour, which represents 12 ppm of silica in the boiler at the end of 24 hr. Many operators set this figure as the limit and resort to blowing down when this figure is approached.

Plants operating with high makeup, not evaporated, have to resort to external chemical treatment for removal of silica. The present effectiveness of such treatment, in the author's opinion, appears to have a limitation of about 2 ppm of silica residual remaining in the water. This may necessitate continuous blowdown in order to maintain the silica in the boiler water under 12 ppm, but frequent blowing down of high-pressure boilers is not looked upon with favor by the operators.

The use of internal chemical treatment for silica has been given some consideration, but as yet has not proved very satisfactory, because of the necessity for very close supervision and control of several variables.

Finally, a knowledge of the combination and form in which silica occurs is most important as it throws light on the physical conditions which play a part in the formation of scale. While chemical analysis of boiler scale will show the total silica present, this may exist in as many as five different forms, all of which have different physical properties. However, the more recent employment of the X-ray diffraction method of analysis of scale has made it possible to identify compounds which from previous knowledge enables one to determine the temperature at which they could have been formed.

An Improved Magnesia Process

"Silica Removal by an Improved Magnesia Process" was the title of the second paper of the session, by **H. L. Tiger,** vice president of The Permutit Company. This process involves the combined use of ionic magnesium and sludges containing undissolved magnesium compounds in which a modified Spaulding Precipitator is employed to afford extended and intimate contact between the water and the sludge. This equipment permits the usual lime-soda reactions to take place at the same time as silica removal and, by the addition of a coagulant, simultaneous turbidity removal can be accomplished. The source of magnesium is low-cost dolomitic lime.

Summarizing the extensive research study of various means of silica removal, as detailed in the paper, the author offered the following conclusions:

(*a*) For any given set of conditions ionic magnesium precipitated as $Mg(OH)_2$ is most efficient, but undissolved magnesium compounds of proper quality (fine particle size, etc.) also give satisfactory results when favorable conditions of sludge concentration and agitation are maintained.

(*b*) The efficiency of removing silica by precipitating ionic magnesium or by undissolved magnesium compounds increases with temperature, but the application of other factors disclosed makes it possible to obtain satisfactory results at low temperatures. Slight pre-warming of the water to about 30 or 40 C (86 to 104 F) reduces the amount of magnesium required to obtain the desired result. Waste heat may be used for this purpose.

(*c*) The efficiency increases with the concentration of the magnesium-containing sludge in contact with the water.

(*d*) Increasing the time of contact with the sludge