

ACTION OF CALCIUM CHLORIDE SOLUTION ON GLASS.

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In the course of some recent experiments on boiler corrosion the author had occasion to place various dilute solutions in contact with iron wire in glass bottles and heat them in an autoclave containing water up to 200 pounds steam pressure, which corresponds to about 200 degrees Centigrade. The heating was continued for periods ranging from three to seven hours.

The solutions were all about fifteenth-equivalent-normal in strength, and included the following substances, separately: sodium nitrate, ammonium nitrate, calcium nitrate, nitric acid, sodium chloride, calcium chloride, magnesium chloride. In each case 250 cc. of the solution was heated in a 500-cubic-centimeter bottle.

In most cases the bottles were appreciably attacked by the solutions, so that the glass stoppers could not be removed and the bottles were noticeably etched inside, sometimes with the formation of scaly matter on the bottles and in the enclosed water.

The effect was very much the most pronounced in the case of the calcium chloride. The solution was heated for 6 hours in a bottle of clear glass of good quality, weighing empty about 275 grams. On opening the autoclave the bottle was found to have been eaten through near the bottom and the rest largely covered with a gelatinous layer which hardened in a few days to an opaque coating. The piece of iron wire in the solution throughout the heating had gained very slightly in weight and in tensile strength. Also, about 90 grams of loose scaly material was found, and the solution, which had been perfectly neutral, had become strongly alkaline. Apparently fully half of the glass had been acted upon, so that this very dilute calcium chloride solution, containing less than 1.5 grams of calcium chloride, had in about 6 hours chemically attacked over 100 grams of glass.

In seeking an explanation of the results, the various constituents of a calcium chloride solution may be considered. These include, according to generally accepted modern theories, water, calcium chloride molecules,

perhaps some hydrated calcium chloride molecules, calcium ions, chlorine ions, calcium hydroxide molecules, hydrochloric acid molecules, hydrogen ions, hydroxyl ions.

Of these ingredients water can hardly be the active agent, or equally marked results would have been obtained in the other cases; of the other chemical substances present, all but calcium chloride molecules—*anhydrous and hydrated*—were present in approximately equal quantities in other solutions tested without corresponding results. The action, then, must be considered catalytic, on account of the quantities involved, and induced by calcium chloride molecules, *anhydrous or hydrated*, and is apparently the hydrolysis of the silicates of the glass, with the formation of more or less hydrated silica and free bases.