

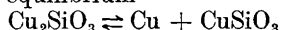
DISCUSSION

Dr. M. W. Travers (*communicated*) :

I fear that the science of glass-making in this, as in other branches, suffers from too much speculation based upon insufficient experimental evidence. Only one series of experimental researches on the coloured glasses, which may be considered to be homogeneous in distinction from the glasses of the gold-ruby type, in which the effect of a range of colouring materials on a range of typical glasses was studied has ever been carried out. I refer to Zsigmondy's work (*Ann. der Physik*, 1901, IV. 4, 60); but of the 90 possible combinations of colouring materials and glasses, he actually examined very few, and only in a few cases did he vary the concentration of the colouring matter in the glass. Other spasmodic investigations have not increased our systematic knowledge of the subject.

I cannot see that any deep mystery attaches to the cobalt and copper glasses which from the results of Zsigmondy (*loc. cit.*) and of Holt and Burgess (*Eng. Ceramic Soc.*, 1905-6, 163), behave similarly to aqueous solution. Cobalt oxide colours boric oxide glass a faint pink, being very insoluble in the glass. The addition of alkali to the boric acid increases the solubility of the cobalt oxide in proportion to the alkali content, and the glass is now blue. Taken with the fact that the boric oxide glass is an electrolyte, and looking at the problem in the light of researches in aqueous solution of cobalt compounds, are we not justified in assuming that the pink and blue colours are due to simple and complex ions? The same remarks apply to green and blue copper glasses; but while the absorption of light by aqueous solution of copper salts has been carefully studied, our knowledge of the glasses is merely qualitative.

The chemistry of the copper ruby glasses has been investigated by Auger (*Compt. Rend.*, 1907, 144, 422), who worked on copper aventurine glass, and found that the separation of copper was due to changes in the equilibrium



The separation of copper can, of course, only take place in a glass free from oxidizing agents and dissolved oxygen. Quantitative investigation might show that similar changes took place in the deposition of gold and other elements in a finely-dispersed state in glass.

Sir H. Jackson's statement on water in the batch—its influence on the subsequent devitrification of the glass—must be limited to certain kinds of glass, and detailed information would be of interest. Formerly all flint glass makers used crystallised potash (12 to 18 per cent. water) in their batch, on account of its freedom from sulphates and chlorides, without ill effects.
