

## Theoretical Consideration for the Mechanism of the Probe Gas for High Vacuum Leak-Detection

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In order to analyze the mechanism of the leak-detection with the probe gas, the substitution sensitivity factor  $\phi$  (J. Blears, J. H. Leck, *Journ. of Sci. Instr.* Sup. No. 1, 22, (1952)) for the ionization gauge (apparent change of air pressure in the vacuum caused by covering leak with probe gas) (mean air pressure before probing) was calculated. It was assumed that, Poiseuille's law is applicable for the gas flow through the leak (J. Blears : *ibid* ; S. Dushman : "Scientific Foundation of Vacuum Technique", p. 84, (John Wiley & Sons, New York, 1949); A. Guthrie, R. K. Wakering : "Vacuum Equipment & Techniques," p. 22, (McGraw-Hill Book Co., New York, 1949)) and the ionization cross-section of the gas molecule is built up as the sum of the contributions from the component atoms (H. S. W. Massey and E. H. S. Burhop : "Electronic Ionic Impact Phenomena," p. 191, (Oxford, at the Clarendon Press, 1952)).

The values of  $\phi$  calculated for  $H_2$ ,  $CO_2$ ,  $C_4H_{10}$  and coal gas were in agreement with the observed values approximately. The theory was, however, invalid for the "vapour" with low vapor pressure at room temperature such as  $C_6H_6$ ,  $CCl_4$  etc. The reason of these disagreements is mainly ascribable to the "imperfection" of vapors; this effect reduces the  $\phi$ -value in a way for which Poiseuille's law is of no quantitative use. So, the more rigorous treatment for vapours would be desirable.

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## On the Constitution of Zinc-Ferrite. (II)

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In the previous report, the constitution of  $Fe_2O_3$ - $ZnFe_2O_4$  system was reported. In this paper explanation is given on the constitution of the  $ZnFe_2O_4$ - $ZnO$  system and the formation of magnetite in the  $Fe_2O_3$ - $ZnO$  system.

$Fe_2O_3$  and  $ZnO$  are mixed in various molar ratio ( $ZnO:Fe_2O_3$ ), and the mixtures are pressed in the mould under 80 kg./cm<sup>2</sup>. pressure and heated at 1000°, 1100° and 1250°C for 3 hours.

For each sintered sample, Debye-Scherrer X-ray photograph was taken, and the magnetic properties were measured by the ballistic galvanometer method. After these experiments

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all the samples were analysed chemically. The results were as follows.

(1) By X-ray investigations, it has been shown that only the pure spinel structure is preserved in the composition 1 : 1 to 1 : 2 ( $\text{ZnO} : \text{Fe}_2\text{O}_3$ ), and free  $\text{Fe}_2\text{O}_3$  is found to be more than 1 : 3. On the contrary, in all samples which contain the excess ZnO more than 1 : 1, both the spinel and ZnO structured are observed. From these results, it seems that the zine-ferrite makes a solid solution with  $\text{Fe}_2\text{O}_3$  readily to some extent, but with ZnO very slightly at high temperature.

(2) Different from the samples containing the excess  $\text{Fe}_2\text{O}_3$  over the stoichiometric amount, the samples with higher ZnO contents have no ferromagnetism.

(3) Pure  $\text{Fe}_2\text{O}_3$  is not decomposed to  $\text{Fe}_3\text{O}_4$  when heated at  $1250^\circ\text{C}$ . But when it is mixed with ZnO, a part of  $\text{Fe}_2\text{O}_3$  is converted to  $\text{Fe}_3\text{O}_4$ . This tendency is marked for the samples with higher  $\text{Fe}_2\text{O}_3$  contents. In the samples containing excess ZnO, the formation of  $\text{Fe}_3\text{O}_4$  from  $\text{Fe}_2\text{O}_3$  is negligible by heating at  $1250^\circ\text{C}$ .

(4)  $\text{Fe}_3\text{O}_4$  thus formed, is almost reoxidized to  $\text{Fe}_2\text{O}_3$  while cooling down in the air.

(5) From our systematic studies, we ought to consider that the ferro-magnetism of zine-ferrite with higher  $\text{Fe}_2\text{O}_3$  contents is not due to the formation of magnetite, but preferable to dissolved  $\text{Fe}_2\text{O}_3$  in the 1 : 1 sample at high temperature.

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## On the Recovery of Copper from Leached Solution of Pyrite Cinder

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When copper leached from pyrite cinder is recovered by scrap cementation method, recovery of copper, state of cemented copper and the scrap loss are affected by the methods of agitation and conditions of solution such as  $\text{Fe}^{2+}$  conc.,  $\text{Cu}^{2+}$  conc., pH value etc.. In this work, these influences have been studied by statistical methods of analysis. Agitation was performed by (1) pneumatic agitation (method A) and (2) air-tight mechanical agitation (method B). Design of experiment was the analysis of variance by Latin square whose factors were  $\text{Fe}^{2+}$  conc. (1~10 g/l),  $\text{Cu}^{2+}$  conc. (0.5~2 g/l) and pH value (0.5~2.5) of the solution. Results are summarized as follows :

(1) Mean value of the recovery of copper in method B is higher than in method A, and difference of mean scrap loss in both methods is not significant.

(2) Significant factors on the recovery of copper in A are  $\text{Fe}^{2+}$  conc. and  $\text{Cu}^{2+}$  conc., on the other hand, in B, none of above factors is significant.

(3) On the scrap loss,  $\text{Fe}^{2+}$  conc. is significant and  $\text{Cu}^{2+}$  conc. seems to be significant in B, but these factors are not so in A.

(4) Recovery of copper in B is higher than A, when scrap is repeatedly used for cementation.

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