Chemical Engineering and Agriculture

Julian E. Mac Farland
graphite in the first case and amorphous carbon in the second. This is in fair agreement with a calorimetric determination made by Ruff.

---

CHEMICAL ENGINEERING AND AGRICULTURE

JULIAN E. MAC FARLAND

Chemical engineering is finding extensive application in two important phases of agriculture, the preparation of fertilizers to enrich the soil and the better utilization of waste agricultural products. The second phase has been studied at Iowa State College, particularly in regard to corncobs and oat hulls. They contain pentosans, which can be converted to furfural, a potentially valuable product. Cobs may be destructively distilled to yield useful products including a char which can be highly activated. Cobs or oat hulls may be treated with a phenol to form a black resin which can be manipulated into a valuable insulating and decorative material.

---

SOLUBILITY IN AUSTENITE OF CARBON FROM
CARBON AND OF CARBON FROM
IRON-CARBIDE

H. L. MAXWELL AND ANSON HAYES

For the well established equilibria:

1. \( \text{Fe}_3\text{C} + \text{CO}; \rightleftharpoons 3\text{Fe} + 2\text{CO} + \Delta H_1 \)
2. \( \text{C} + \text{CO}; \rightleftharpoons 2\text{CO} + \Delta H_2 \)
3. \( \text{[C]}_1 + \text{CO}; \rightleftharpoons 2\text{CO} \)
4. \( \text{[C]}_2 + \text{CO}; \rightleftharpoons 2\text{CO} \)
5. \( \text{[C]} + \text{CO}; \rightleftharpoons 2\text{CO} \)

Where \([C]\) = concentration of dissolved carbon in austenite, \([C]_1 = \) saturated value of carbon from carbon, \([C]_2 = \) saturated value of carbon from iron carbide, and \(K_1, K_2, K_3, \ldots\) are the gaseous equilibrium constants for these reactions. Thermodynamics demands \(K_2 = K_4, K_2 = K_5\) and that \(K_3\) is a function of the concentration of carbon in austenite. Since iron-carbon alloys graphitize down to some 0.9% combined carbon or less, \(\text{Fe}_3\text{C}\) is metastable with respect to carbon from 720° to 1130°C. Since the heat of formation of \(\text{Fe}_3\text{C}\) is -15100 calories, it follows from the equation

\[
\frac{d}{dT} (\log K) = \frac{\Delta H}{RT^2}
\]

and from the metastability of \(\text{Fe}_3\text{C}\) that the carbon solubility line of the iron-carbon diagram lies to the left of the cementite solubility line and has a greater slope.