60. The Temperature Calculation of the Revolving Converter.

Junji Furukawa and *Tsutomu Omae.*

We have already discussed the temperature distribution of the multi-tublar converter used for gaseous phase synthesis of vinyl-acetate or vinyl-chloride, then it was found that the diameter of each tube was limited in small scale (1—1.5 inches), because of the low thermal-conductivity of the catalyst-bed. By reason of this defect, the tube-type converter should have thousands of tubes in case of industrial scale and by this fact the construction of converter need tremendous cost and labour. Then we suggest the revolving converter or stirring converter as the adequate device plan for this subject; by these mechanisms the catalyst-bed becomes to have high thermal-conductivity, hence the diameter of catalyst-bed is permitted to enlarge magnificently.

To estimate the ability of this converter, we calculate the temperature-distribution of the catalyst-bed (θ °C) and of the temperature-keeping jacket (θ_1 °C) and the quantity of heat (q_e) should be as follows.

$$\theta_1 = -\frac{qAk}{2\pi R_1 U_1} e^{-kl/v} + \theta_0. \qquad (1)$$

$$q_e = U_2(2\pi R_2)(\theta_1 - \theta_2) - U_2(2\pi R_1)(\theta - \theta_1). \qquad (2)$$

For the practical example the value of θ_1 and q_e are as follows. When the space-time-yield of vinyl-acetate synthesis catalyst is 1 (ton/day-m^3-of—catalyst).

L (m)	0	1	2	3	4	5
θ_1 (°C)	20	27	35	42	47	51
q_e (kcal/hr-m)	0	200	380	550	730	900

When the heat transmission ratio between the jacket and the atmosphere (U_2) vary between ∞ ~2.3 Kcal/hr-m^2 °C, the max. diameter of converter (R_1) max, is calculated by equation (3) and the consequence is as follows:

$$R_{1max} = 4U_1(\theta_0 - \theta_2)/qk. \qquad (3)$$

U_{2max}	∞	10	7.5	4.3	2.3
R_{1max} (m)	0.45	0.25	0.21	0.18	0.15

θ_2; room temperature θ_0; entrancetemp of θ °C. q; reaction heat. A; Cros area of catalyst. k; rate constant. v; reactant gas velocity R; diameter of jacket.