

$$\begin{aligned}
F = & \frac{2\sigma_0\pi}{3\sqrt{\alpha_c}} (2a_1 - 3a_2) \left\{ \frac{2\alpha_c R_c^2 + \beta_c}{4\alpha_c} \left[ \text{Ln}(2\alpha_c R_c^2 + \beta_c) - 1 \right] \right. \\
& - \frac{\beta_c}{4\alpha_c} \left[ \text{Ln}(\beta_c) - 1 \right] - \frac{1}{2} R_c^2 \text{Ln}(2\alpha_c R_c^2 + \beta_c) \left. \right\} - \frac{1}{2} (4a_1 + a_2) \pi b R_c^4 \\
& - \frac{4}{3} \pi \sigma_0 \left\{ 7a_1 \left[ \frac{1}{2\alpha_c} (\alpha_c R_c^4 + \beta_c R_c^2 + \gamma_c)^{1/2} - \frac{1}{4} \beta_c \alpha_c^{-3/2} \text{Ln} \left\{ \frac{\beta_c}{2\sqrt{\alpha_c}} \right. \right. \right. \\
& + \left. \left. \left. \sqrt{\alpha_c} R_c^2 + (\alpha_c R_c^4 + \beta_c R_c^2 + \gamma_c)^{1/2} \right\} - \frac{\sqrt{\gamma_c}}{2\alpha_c} + \frac{1}{4} \beta_c \alpha_c^{-3/2} \right. \right. \\
& \left. \left. \text{Ln} \left( \frac{\beta_c}{2\sqrt{\alpha_c}} + \sqrt{\gamma_c} \right) \right] + 3a_3 \left[ \frac{1}{2\sqrt{\alpha_c}} \text{Ln} \left\{ \frac{\beta_c}{2\sqrt{\alpha_c}} + \sqrt{\alpha_c} R_c^2 \right. \right. \right. \\
& \left. \left. \left. + (\alpha_c R_c^4 + \beta_c R_c^2 + \gamma_c)^{1/2} \right\} - \frac{1}{2\sqrt{\alpha_c}} \text{Ln} \left( \frac{\beta_c}{2\sqrt{\alpha_c}} + \sqrt{\gamma_c} \right) \right] \right\} \\
& - \pi \left( \frac{2}{3} a_1 b R_c^2 - a_2 b R_c^2 + 2a_3 b + P_c \right) R_c^2
\end{aligned} \tag{43}$$