$$S = -\left(\frac{\partial G}{\partial T}\right)_{p,n_i} = -\sum_i \left\{ \frac{\partial \mu_i^{\circ\phi}(T)}{\partial T} + R \ln\left(\frac{n_i^\phi}{\sum n_i^\phi}\right) + \alpha R \ln \frac{p}{p_0} \right\} n_i^\phi$$