$\beta = \frac{1}{k_b T}$, k_b is Boltzmann Constant, T is temperature

$a_{exc} = \frac{A_{total}}{V}$, A_{total} is the total free energy of the system, V is volume

P_{exc} is the excess pressure

$e = \frac{E_{total}}{V}$, E_{total} is the total energy of the system

ρ is number density

For solid, we fit the $\beta\rho a_{exc}$, βP_{exc} and ρe together, their polynomials as follow:

$$\beta\rho a_{exc}(\rho,\beta) = \frac{3\rho}{2}\ln(\beta) + \sum_{n_{min}}^{n_{max}}\sum_{m_{min}}^{m_{max}} a_{nm}\rho^n\beta^m$$

$$\beta P_{exc}(\rho,\beta) = \sum_{n_{min}}^{n_{max}}\sum_{m_{min}}^{m_{max}} (n-1)a_{nm}\rho^n\beta^m$$

$$\rho e = \frac{3\rho}{2}\beta^{-1} + \sum_{n_{min}}^{n_{max}}\sum_{m_{min}}^{m_{max}} m a_{nm}\rho^n\beta^{m-1}$$

a_{nm} *is the fitting parameter*

$n_{min} = 0, n_{max} = 5, m_{min} = -2, m_{max} = 1$