Page 182, equation (4.178)

The dissipation Π_0 defined by (4.171) can be written as follows:

$$\Pi_0 = -\sum_{\beta=1}^{n-1} (g_\beta - g_n)\, r_\beta = -\sum_{\beta=1}^{n-1} g_\beta r_\beta + g_n \sum_{\beta=1}^{n-1} r_\beta. \tag{1}$$

From balance (4.20) follows:

$$r_n = -\sum_{\beta=1}^{n-1} r_\beta \tag{2}$$

Using (2) in (1) we have:

$$\Pi_0 = -\sum_{\beta=1}^{n-1} g_\beta r_\beta - g_n r_n = -\sum_{\alpha=1}^{n} g_\alpha r_\alpha. \tag{3}$$

Substituting from (4.172) and (4.26) into (3) successively we get:

$$-\sum_{\alpha=1}^{n} g_\alpha r_\alpha = -\sum_{\alpha=1}^{n} \frac{\mu_\alpha}{M_\alpha} r_\alpha = -\sum_{\alpha=1}^{n} \mu_\alpha J^\alpha. \tag{4}$$

Referring to eqs. (4.173) and (4.33) the last product in (4) can be written:

$$-\sum_{\alpha=1}^{n} \mu_\alpha J^\alpha = -\vec{\mu}.\vec{J}. \tag{5}$$

Introducing the decomposition of the chemical potential, (4.174), we obtain:

$$-\vec{\mu}.\vec{J} = -(-\vec{A} + \vec{B}).\vec{J} = \vec{A}.\vec{J} \tag{6}$$

where we used the facts that $\vec{B} \in \mathcal{W}$ ((4.174)), $\vec{J} \in \mathcal{V}$ ((4.36)), and $\mathcal{W} \perp \mathcal{V}$ (after (4.36) and also (4.174)) from which $\vec{B}.\vec{J} = 0$ follows.

The last product in (6) can be written with the help of (4.43) and (4.175) as follows:

$$\vec{A}.\vec{J} = \sum_{p=1}^{n-h} J_p A^p \tag{7}$$

Combining (4.171) with (3)-(7), eq.(4.178) results.

Note that the whole procedure can be generalized to a mixture of reacting and non-reacting components. Without loss of generality let us suppose that the first m components are reacting and components $m+1, m+2, \ldots, n$ are non-reacting. Then $\Pi_0 = -\sum_{\psi=1}^{m-1} (g_\psi - g_m)\, r_\psi$, $\sum_{\varphi=m+1}^{n} g_\varphi r_\varphi = 0$ can be used in balance (4.20) and instead of (2) we have $r_m = -\sum_{\psi=1}^{m-1} r_\psi$; the other parts of the derivation remain unchanged as well as the final result (4.178).