the bulk modulus of pore-free polycrystalline aggregates is given by

$$B^* = \frac{1}{2}\,(B_1 + B_2) \tag{7}$$

where B_1 is given by Eq. (4) and

$$B_2 = -V.\frac{dp}{dV}\Bigg|_{\varepsilon_{ij}(C_{ijkl},\,\tilde{R})\,=\,\bar{\varepsilon}} = f_2\,(c_{\mu\nu}) \tag{8}$$

where $c_{\mu\nu}$ are the single-crystal second-order elastic stiffnesses, ε_{ij} are the strain tensors, and f_2 is a functional constant which depends on the crystal symmetry. Hence, the appropriate Murnaghan parameters for the polycrystalline materials are

$$B_o^* = \{B^{*T}\}_{p=0} \tag{9}$$

and

$$B_o^{*\prime} = \{(B^{*T})'\}_{p=0} \tag{10}$$

where, as before, the prime refers to the isothermal pressure derivative.

Note that B_1 and B_2 are the well-known Reuss and Voigt limits, respectively; for crystals of general symmetry, rigorous expressions for B_1 and B_2 are as follows [9]: