Response Tensors up to 4th rank in C_{6v}

— polar tensors —

$$C^{(0,Q)} = \left(C^{(0,Q)} \right)$$

$$C^{(0,Q)} = Q_0$$

$$C^{(1,Q)} = \begin{pmatrix} 0 & 0 & C_z^{(1,Q)} \end{pmatrix}$$

$$C_z^{(1,Q)} = Q_z$$

$$S^{(2,Q)} = \begin{pmatrix} S_{xx}^{(2,Q)} & 0 & 0 \\ 0 & S_{xx}^{(2,Q)} & 0 \\ 0 & 0 & S_{zz}^{(2,Q)} \end{pmatrix}$$

$$S_{xx}^{(2,Q)} = Q_0 - Q_u$$
$$S_{zz}^{(2,Q)} = Q_0 + 2Q_u$$

$$S^{(3,Q)} = \begin{pmatrix} 0 & 0 & S_{1z}^{(3,Q)} \\ 0 & 0 & S_{2z}^{(3,Q)} \\ 0 & 0 & S_{3z}^{(3,Q)} \\ 0 & \frac{5S_{1z}^{(3,Q)}}{4} - \frac{7S_{2z}^{(3,Q)}}{4} + \frac{S_{3z}^{(3,Q)}}{2} & 0 \\ \frac{9S_{1z}^{(3,Q)}}{4} - \frac{11S_{2z}^{(3,Q)}}{4} + \frac{S_{3z}^{(3,Q)}}{2} & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$$

$$S_{1z}^{(3,Q)} = -3Q_3^{\alpha} + Q_z[2]$$
$$S_{2z}^{(3,Q)} = -Q_3^{\alpha} + Q_z[2]$$
$$S_{3z}^{(3,Q)} = 2Q_3^{\alpha} + 2Q_z[1] + Q_z[2]$$

$$A^{(3,Q)} = \begin{pmatrix} 0 & A_{4y}^{(3,Q)} & 0 \\ -A_{4y}^{(3,Q)} & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$$

$$A_{4y}^{(3,Q)} = Q_z[3]$$

$$S^{(4,Q)} = \begin{pmatrix} S_{11}^{(4,Q)} & S_{12}^{(4,Q)} & S_{13}^{(4,Q)} & 0 & 0 & 0 \\ S_{12}^{(4,Q)} & S_{11}^{(4,Q)} & S_{13}^{(4,Q)} & 0 & 0 & 0 \\ S_{13}^{(4,Q)} & S_{13}^{(4,Q)} & S_{33}^{(4,Q)} & 0 & 0 & 0 \\ 0 & 0 & 0 & S_{44}^{(4,Q)} & 0 & 0 \\ 0 & 0 & 0 & 0 & S_{44}^{(4,Q)} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{S_{11}^{(4,Q)}}{2} - \frac{S_{12}^{(4,Q)}}{2} \end{pmatrix}$$

$$S_{11}^{(4,Q)} = Q_0[1] + 2Q_0[2] + 3Q_4 - 2Q_u[1] - 4Q_u[2]$$

$$S_{12}^{(4,Q)} = Q_0[1] + Q_4 - 2Q_u[1]$$

$$S_{13}^{(4,Q)} = Q_0[1] - 4Q_4 + Q_u[1]$$

$$S_{33}^{(4,Q)} = Q_0[1] + 2Q_0[2] + 8Q_4 + 4Q_u[1] + 8Q_u[2]$$

$$S_{44}^{(4,Q)} = Q_0[2] - 4Q_4 + Q_u[2]$$

$$\bar{S}^{(4,Q)} = \begin{pmatrix} 0 & 0 & \bar{S}_{13}^{(4,Q)} & 0 & 0 & 0 \\ 0 & 0 & \bar{S}_{13}^{(4,Q)} & 0 & 0 & 0 \\ -\bar{S}_{13}^{(4,Q)} & -\bar{S}_{13}^{(4,Q)} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$\bar{S}_{13}^{(4,Q)} = 3Q_u[3]$$

$$A^{(4,Q)} = \begin{pmatrix} A_{xx}^{(4,Q)} & 0 & 0 \\ 0 & A_{xx}^{(4,Q)} & 0 \\ 0 & 0 & A_{zz}^{(4,Q)} \end{pmatrix}$$

$$A_{xx}^{(4,Q)} = Q_0[3] - 2Q_u[6]$$

$$A_{zz}^{(4,Q)} = Q_0[3] + 4Q_u[6]$$

$$M^{(4,Q)} = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \\ M_{4x}^{(4,Q)} & 0 & 0 \\ 0 & -M_{4x}^{(4,Q)} & 0 \\ 0 & 0 & 0 \end{pmatrix}$$

$$M_{4x}^{(4,Q)} = -3Q_u[4]$$

$$\bar{M}^{(4,Q)} = \begin{pmatrix} 0 & 0 & 0 & \bar{M}_{x4}^{(4,Q)} & 0 & 0 \\ 0 & 0 & 0 & 0 & -\bar{M}_{x4}^{(4,Q)} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$\bar{M}_{x4}^{(4,Q)} = -3Q_u[5]$$

$$A^{(2,G)} = \begin{pmatrix} 0 & A^{(2,G)}_{xy} & 0 \\ -A^{(2,G)}_{xy} & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$$

$$A^{(2,G)}_{xy} = Q_z$$

$$S^{(3,G)} = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \\ S^{(3,G)}_{4x} & 0 & 0 \\ 0 & -S^{(3,G)}_{4x} & 0 \\ 0 & 0 & 0 \end{pmatrix}$$

$$S^{(3,G)}_{4x} = -3Q_u[1]$$

$$A^{(3,G)} = \begin{pmatrix} A^{(3,G)}_{4x} & 0 & 0 \\ 0 & A^{(3,G)}_{4x} & 0 \\ 0 & 0 & A^{(3,G)}_{6z} \end{pmatrix}$$

$$A^{(3,G)}_{4x} = Q_0 - Q_u[2]$$
$$A^{(3,G)}_{6z} = Q_0 + 2Q_u[2]$$

$$\bar{S}^{(4,G)} = \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & \bar{S}^{(4,G)}_{16} \\ 0 & 0 & 0 & 0 & 0 & \bar{S}^{(4,G)}_{26} \\ 0 & 0 & 0 & 0 & 0 & -\bar{S}^{(4,G)}_{16} - \bar{S}^{(4,G)}_{26} \\ 0 & 0 & 0 & 0 & \frac{7\bar{S}^{(4,G)}_{16}}{4} + \frac{9\bar{S}^{(4,G)}_{26}}{4} & 0 \\ 0 & 0 & 0 & -\frac{7\bar{S}^{(4,G)}_{16}}{4} - \frac{9\bar{S}^{(4,G)}_{26}}{4} & 0 & 0 \\ -\bar{S}^{(4,G)}_{16} & -\bar{S}^{(4,G)}_{26} & \bar{S}^{(4,G)}_{16} + \bar{S}^{(4,G)}_{26} & 0 & 0 & 0 \end{pmatrix}$$

$$\bar{S}^{(4,G)}_{16} = -6Q^{\alpha}_3[1] + 2Q_z[1]$$
$$\bar{S}^{(4,G)}_{26} = 2Q^{\alpha}_3[1] - 2Q_z[1]$$

$$\bar{A}^{(4,G)} = \begin{pmatrix} 0 & \bar{A}^{(4,G)}_{xy} & 0 \\ -\bar{A}^{(4,G)}_{xy} & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$$

$$\bar{A}^{(4,G)}_{xy} = Q_z[6]$$

$$M^{(4,G)} = \begin{pmatrix} 0 & 0 & M^{(4,G)}_{1z} \\ 0 & 0 & M^{(4,G)}_{2z} \\ 0 & 0 & M^{(4,G)}_{3z} \\ 0 & \frac{5M^{(4,G)}_{1z}}{4} - \frac{7M^{(4,G)}_{2z}}{4} + \frac{M^{(4,G)}_{3z}}{2} & 0 \\ \frac{9M^{(4,G)}_{1z}}{4} - \frac{11M^{(4,G)}_{2z}}{4} + \frac{M^{(4,G)}_{3z}}{2} & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$$

$$M_{1z}^{(4,G)} = -3Q_3^\alpha[2] + Q_z[3]$$

$$M_{2z}^{(4,G)} = -Q_3^\alpha[2] + Q_z[3]$$

$$M_{3z}^{(4,G)} = 2Q_3^\alpha[2] + 2Q_z[2] + Q_z[3]$$

$$\bar{M}^{(4,G)} = \begin{pmatrix} 0 & 0 & 0 & 0 & \bar{M}_{x5}^{(4,G)} & 0 \\ 0 & 0 & 0 & \bar{M}_{y4}^{(4,G)} & 0 & 0 \\ \bar{M}_{z1}^{(4,G)} & -\bar{M}_{x5}^{(4,G)} + \bar{M}_{y4}^{(4,G)} + \bar{M}_{z1}^{(4,G)} & -\frac{7\bar{M}_{x5}^{(4,G)}}{2} + \frac{11\bar{M}_{y4}^{(4,G)}}{2} + \bar{M}_{z1}^{(4,G)} & 0 & 0 & 0 \end{pmatrix}$$

$$\bar{M}_{x5}^{(4,G)} = -3Q_3^\alpha[3] + Q_z[4]$$

$$\bar{M}_{y4}^{(4,G)} = -Q_3^\alpha[3] + Q_z[4]$$

$$\bar{M}_{z1}^{(4,G)} = -3Q_3^\alpha[3] + Q_z[5]$$