

MPG No. 6.3.19 2'2'2 (2'2'2 setting) [Type III, orthorhombic] [M tensor]

* Rank 0 tensor. * Rank 1 tensor.

$$\begin{bmatrix} 0 & 0 & M_z \end{bmatrix}$$

$$M_z = M_{pz}^{(1)}$$

* Rank 2 tensor (s).

$$\begin{bmatrix} 0 & M_{xy} & 0 \\ M_{xy} & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$M_{xy} = M_{dxy}^{(1)}$$

* Rank 2 tensor (a).

$$\begin{bmatrix} 0 & M_{xy} & 0 \\ -M_{xy} & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$M_{xy} = T_{pz}^{(1)}$$

* Rank 3 tensor (s).

$$\begin{bmatrix} 0 & 0 & M_{xxz} \\ 0 & 0 & M_{yyz} \\ 0 & 0 & M_{zzz} \\ 0 & M_{yzy} & 0 \\ M_{zxx} & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$M_{xxz} = -M_{faz}^{(1)} + M_{fbz}^{(1)} + M_{pz}^{(1)} - 2T_{dxy}^{(1)}$$

$$M_{yyz} = -M_{faz}^{(1)} - M_{fbz}^{(1)} + M_{pz}^{(1)} + 2T_{dxy}^{(1)}$$

$$M_{zzz} = 2M_{faz}^{(1)} + M_{pz}^{(1)} + 2M_{pz}^{(2)}$$

$$M_{yzy} = -M_{faz}^{(1)} - M_{fbz}^{(1)} + M_{pz}^{(2)} - T_{dxy}^{(1)}$$

$$M_{zxx} = -M_{faz}^{(1)} + M_{fbz}^{(1)} + M_{pz}^{(2)} + T_{dxy}^{(1)}$$

* Rank 3 tensor (a).

$$\begin{bmatrix} 0 & M_{yzy} & 0 \\ M_{zxx} & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$M_{yzy} = M_{pz}^{(3)} + T_{dxy}^{(2)}$$

$$M_{zxx} = -M_{pz}^{(3)} + T_{dxy}^{(2)}$$

* Rank 4 tensor (sss).

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & M_{xxxx} \\ 0 & 0 & 0 & 0 & 0 & M_{yyxy} \\ 0 & 0 & 0 & 0 & 0 & M_{zzxy} \\ 0 & 0 & 0 & 0 & M_{yzzx} & 0 \\ 0 & 0 & 0 & M_{yzzx} & 0 & 0 \\ M_{xxxx} & M_{yyxy} & M_{zzxy} & 0 & 0 & 0 \end{bmatrix}$$

$$M_{xxxy} = M_{dxy}^{(1)} + 2M_{dxy}^{(2)} + M_{gaz}^{(1)} - M_{gbz}^{(1)}$$

$$M_{yyxy} = M_{dxy}^{(1)} + 2M_{dxy}^{(2)} - M_{gaz}^{(1)} - M_{gbz}^{(1)}$$

$$M_{zzxy} = M_{dxy}^{(1)} + 2M_{gbz}^{(1)}$$

$$M_{yzzx} = M_{dxy}^{(2)} + 2M_{gbz}^{(1)}$$

* Rank 4 tensor (ssa).

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & M_{xxxy} \\ 0 & 0 & 0 & 0 & 0 & M_{yyxy} \\ 0 & 0 & 0 & 0 & 0 & M_{zzxy} \\ 0 & 0 & 0 & 0 & M_{yzzx} & 0 \\ 0 & 0 & 0 & -M_{yzzx} & 0 & 0 \\ -M_{xxxy} & -M_{yyxy} & -M_{zzxy} & 0 & 0 & 0 \end{bmatrix}$$

$$M_{xxxy} = M_{dxy}^{(3)} - 2T_{faz}^{(1)} + 2T_{fbz}^{(1)} + 2T_{pz}^{(1)}$$

$$M_{yyxy} = M_{dxy}^{(3)} + 2T_{faz}^{(1)} + 2T_{fbz}^{(1)} - 2T_{pz}^{(1)}$$

$$M_{zzxy} = M_{dxy}^{(3)} - 4T_{fbz}^{(1)}$$

$$M_{yzzx} = -4T_{faz}^{(1)} - T_{pz}^{(1)}$$

* Rank 4 tensor (aas).

$$\begin{bmatrix} 0 & M_{yzzx} & 0 \\ M_{yzzx} & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$M_{yzzx} = 2M_{dxy}^{(4)}$$

* Rank 4 tensor (aaa).

$$\begin{bmatrix} 0 & M_{yzzx} & 0 \\ -M_{yzzx} & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$M_{yzzx} = -T_{pz}^{(2)}$$

* Rank 4 tensor (sa).

$$\begin{bmatrix} 0 & 0 & M_{xxxy} \\ 0 & 0 & M_{yyxy} \\ 0 & 0 & M_{zzxy} \\ 0 & M_{yzzx} & 0 \\ M_{zxyz} & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$M_{xxxy} = -2M_{dxy}^{(5)} - T_{faz}^{(2)} + T_{fbz}^{(2)} + T_{pz}^{(3)}$$

$$M_{yyxy} = 2M_{dxy}^{(5)} - T_{faz}^{(2)} - T_{fbz}^{(2)} + T_{pz}^{(3)}$$

$$M_{zzxy} = 2T_{faz}^{(2)} + T_{pz}^{(3)} + 2T_{pz}^{(4)}$$

$$M_{yzzx} = -M_{dxy}^{(5)} - T_{faz}^{(2)} - T_{fbz}^{(2)} + T_{pz}^{(4)}$$

$$M_{zxyz} = M_{dxy}^{(5)} - T_{faz}^{(2)} + T_{fbz}^{(2)} + T_{pz}^{(4)}$$

* Rank 4 tensor (as).

$$\begin{bmatrix} 0 & 0 & 0 & 0 & M_{yzzx} & 0 \\ 0 & 0 & 0 & M_{zxyz} & 0 & 0 \\ M_{xyxx} & M_{xyyy} & M_{xyzz} & 0 & 0 & 0 \end{bmatrix}$$

$$M_{yzzx} = M_{dxy}^{(6)} - T_{faz}^{(3)} + T_{fbz}^{(3)} + T_{pz}^{(6)}$$

$$M_{zxyz} = -M_{dxy}^{(6)} - T_{faz}^{(3)} - T_{fbz}^{(3)} + T_{pz}^{(6)}$$

$$M_{xyxx} = -2M_{dxy}^{(6)} - T_{faz}^{(3)} + T_{fbz}^{(3)} + T_{pz}^{(5)}$$

$$M_{xyyy} = 2M_{dxy}^{(6)} - T_{faz}^{(3)} - T_{fbz}^{(3)} + T_{pz}^{(5)}$$

$$M_{xyzz} = 2T_{faz}^{(3)} + T_{pz}^{(5)} + 2T_{pz}^{(6)}$$

* Rank 4 tensor (s).

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & M_{xxx} & 0 & 0 & M_{xxy} \\ 0 & 0 & 0 & 0 & 0 & M_{yyx} & 0 & 0 & M_{yyx} \\ 0 & 0 & 0 & 0 & 0 & M_{zzy} & 0 & 0 & M_{zzy} \\ 0 & 0 & 0 & 0 & M_{yzz} & 0 & 0 & M_{yzz} & 0 \\ 0 & 0 & 0 & M_{zxy} & 0 & 0 & M_{zxz} & 0 & 0 \\ M_{xyxx} & M_{xyyy} & M_{xyzz} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$M_{xxx} = M_{dxy}^{(1)} + 2M_{dxy}^{(2)} + M_{dxy}^{(3)} - 2M_{dxy}^{(5)} + M_{gaz}^{(1)} - M_{gbz}^{(1)} - 2T_{faz}^{(1)} - T_{fbz}^{(1)} + 2T_{fbz}^{(2)} + T_{fbz}^{(1)} + T_{pz}^{(3)}$$

$$M_{xxy} = M_{dxy}^{(1)} + 2M_{dxy}^{(2)} + M_{dxy}^{(3)} + 2M_{dxy}^{(5)} + M_{gaz}^{(1)} - M_{gbz}^{(1)} - 2T_{faz}^{(1)} + T_{fbz}^{(2)} + 2T_{fbz}^{(1)} - T_{fbz}^{(2)} + 2T_{pz}^{(1)} - T_{pz}^{(3)}$$

$$M_{yyx} = M_{dxy}^{(1)} + 2M_{dxy}^{(2)} + M_{dxy}^{(3)} + 2M_{dxy}^{(5)} - M_{gaz}^{(1)} - M_{gbz}^{(1)} + 2T_{faz}^{(1)} - T_{fbz}^{(2)} + 2T_{fbz}^{(1)} - T_{fbz}^{(2)} - 2T_{pz}^{(1)} + T_{pz}^{(3)}$$

$$M_{yyx} = M_{dxy}^{(1)} + 2M_{dxy}^{(2)} + M_{dxy}^{(3)} - 2M_{dxy}^{(5)} - M_{gaz}^{(1)} - M_{gbz}^{(1)} + 2T_{faz}^{(1)} + T_{fbz}^{(2)} + 2T_{fbz}^{(1)} - 2T_{pz}^{(1)} - T_{pz}^{(3)}$$

$$M_{zzy} = M_{dxy}^{(1)} + M_{dxy}^{(3)} + 2M_{gbz}^{(1)} + 2T_{fbz}^{(2)} - 4T_{faz}^{(1)} + T_{pz}^{(3)} + 2T_{pz}^{(4)}$$

$$M_{zzy} = M_{dxy}^{(1)} + M_{dxy}^{(3)} + 2M_{gbz}^{(1)} - 2T_{faz}^{(2)} - 4T_{fbz}^{(1)} - T_{pz}^{(3)} - 2T_{pz}^{(4)}$$

$$M_{yzz} = M_{dxy}^{(2)} - M_{dxy}^{(5)} + 2M_{gbz}^{(1)} - 4T_{faz}^{(1)} - T_{fbz}^{(2)} - T_{fbz}^{(1)} - T_{pz}^{(4)}$$

$$M_{yzz} = M_{dxy}^{(2)} + M_{dxy}^{(5)} + 2M_{gbz}^{(1)} - 4T_{faz}^{(1)} + T_{faz}^{(2)} + T_{fbz}^{(2)} - T_{pz}^{(1)} - T_{pz}^{(4)}$$

$$M_{zxy} = M_{dxy}^{(2)} + M_{dxy}^{(5)} + 2M_{gbz}^{(1)} + 4T_{faz}^{(1)} - T_{fbz}^{(2)} + T_{fbz}^{(1)} + T_{pz}^{(1)} + T_{pz}^{(4)}$$

$$M_{zxz} = M_{dxy}^{(2)} - M_{dxy}^{(5)} + 2M_{gbz}^{(1)} + 4T_{faz}^{(1)} + T_{faz}^{(2)} - T_{fbz}^{(1)} + T_{pz}^{(1)} - T_{pz}^{(4)}$$

$$M_{xyxx} = M_{dxy}^{(1)} + 2M_{dxy}^{(2)} - M_{dxy}^{(3)} + M_{gaz}^{(1)} - M_{gbz}^{(1)} + 2T_{faz}^{(1)} - 2T_{fbz}^{(1)} - 2T_{pz}^{(1)}$$

$$M_{xyyy} = M_{dxy}^{(1)} + 2M_{dxy}^{(2)} - M_{dxy}^{(3)} - M_{gaz}^{(1)} - M_{gbz}^{(1)} - 2T_{faz}^{(1)} - 2T_{fbz}^{(1)} + 2T_{pz}^{(1)}$$

$$M_{xyzz} = M_{dxy}^{(1)} - M_{dxy}^{(3)} + 2M_{gbz}^{(1)} + 4T_{fbz}^{(1)}$$

* Rank 4 tensor (a).

$$\begin{bmatrix} 0 & 0 & 0 & 0 & M_{yzz} & 0 & 0 & M_{yzz} & 0 \\ 0 & 0 & 0 & M_{zxy} & 0 & 0 & M_{zxz} & 0 & 0 \\ M_{xyxx} & M_{xyyy} & M_{xyzz} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$M_{yzz} = 2M_{dxy}^{(4)} + M_{dxy}^{(6)} - T_{faz}^{(3)} + T_{fbz}^{(3)} - T_{pz}^{(2)} + T_{pz}^{(6)}$$

$$M_{yzz} = -2M_{dxy}^{(4)} + M_{dxy}^{(6)} - T_{faz}^{(3)} + T_{fbz}^{(3)} + T_{pz}^{(2)} + T_{pz}^{(6)}$$

$$M_{zxy} = 2M_{dxy}^{(4)} - M_{dxy}^{(6)} - T_{faz}^{(3)} - T_{fbz}^{(3)} + T_{pz}^{(2)} + T_{pz}^{(6)}$$

$$M_{zxz} = -2M_{dxy}^{(4)} - M_{dxy}^{(6)} - T_{faz}^{(3)} - T_{fbz}^{(3)} - T_{pz}^{(2)} + T_{pz}^{(6)}$$

$$M_{xyxx} = -2M_{dxy}^{(6)} - T_{faz}^{(3)} + T_{fbz}^{(3)} + T_{pz}^{(5)}$$

$$M_{xyyy} = 2M_{dxy}^{(6)} - T_{faz}^{(3)} - T_{fbz}^{(3)} + T_{pz}^{(5)}$$

$$M_{xyzz} = 2T_{faz}^{(3)} + T_{pz}^{(5)} + 2T_{pz}^{(6)}$$

* Rank 4 tensor (t).

$$\begin{bmatrix} 0 & M_{xxxy} & 0 \\ M_{yyyx} & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & M_{zzxy} & 0 \\ M_{xxyx} & 0 & 0 \\ M_{yzzx} & 0 & 0 \\ 0 & 0 & 0 \\ 0 & M_{xyyy} & 0 \\ 0 & 0 & \frac{M_{xxxu}}{2} - \frac{M_{xxyx}}{2} + M_{xyyy} - M_{yyyx} + M_{zzxy} \end{bmatrix}$$

$$M_{xxxy} = M_{dxy}^{(1)} + 2M_{dxy}^{(2)} + M_{dxy}^{(3)} - 2M_{dxy}^{(5)} + M_{gaz}^{(1)} - M_{gbz}^{(1)}$$

$$M_{yyyx} = M_{dxy}^{(1)} + 2M_{dxy}^{(2)} + M_{dxy}^{(3)} - 2M_{dxy}^{(5)} - M_{gaz}^{(1)} - M_{gbz}^{(1)}$$

$$M_{zzxy} = M_{dxy}^{(1)} + M_{dxy}^{(3)} + 2M_{gbz}^{(1)}$$

$$M_{xxyx} = M_{dxy}^{(1)} + 2M_{dxy}^{(2)} + M_{dxy}^{(3)} + 2M_{dxy}^{(5)} + M_{gaz}^{(1)} - M_{gbz}^{(1)}$$

$$M_{yzzx} = M_{dxy}^{(2)} - M_{dxy}^{(5)} + 2M_{gbz}^{(1)}$$

$$M_{xyyy} = M_{dxy}^{(1)} + 2M_{dxy}^{(2)} - M_{dxy}^{(3)} - M_{gaz}^{(1)} - M_{gbz}^{(1)}$$