

MPG No. 14.5.52 $\bar{4}2'm'$ (- $42'm'$ setting) [Type III, tetragonal] [M tensor]

* Rank 0 tensor. * Rank 1 tensor.

$$[0 \ 0 \ M_z]$$

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

* 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). * Rank 3 tensor (s).

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

$$M_{xxz} = -M_{faz}^{(1)} + M_{pz}^{(1)}$$

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

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

* Rank 3 tensor (a).

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

$$M_{yzy} = M_{pz}^{(3)}$$

* Rank 4 tensor (sss).

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

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

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

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

* Rank 4 tensor (ssa).

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

$$\begin{aligned} M_{xxyy} &= M_{dxy}^{(3)} + 2T_{fbz}^{(1)} \\ M_{zzxy} &= M_{dxy}^{(3)} - 4T_{fbz}^{(1)} \end{aligned}$$

* 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). * Rank 4 tensor (sa).

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

$$M_{xxyy} = -2M_{dxy}^{(5)} + T_{fbz}^{(2)}$$

$$M_{yzzx} = -M_{dxy}^{(5)} - T_{fbz}^{(2)}$$

* Rank 4 tensor (as).

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

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

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

* Rank 4 tensor (s).

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & M_{xxyy} & 0 & 0 & M_{xxyx} \\ 0 & 0 & 0 & 0 & 0 & M_{xxyx} & 0 & 0 & M_{xxyy} \\ 0 & 0 & 0 & 0 & 0 & M_{zzxy} & 0 & 0 & M_{zzxy} \\ 0 & 0 & 0 & 0 & M_{yzzx} & 0 & 0 & M_{yzzx} & 0 \\ 0 & 0 & 0 & M_{yzzx} & 0 & 0 & M_{yzzx} & 0 & 0 \\ M_{xyxx} & M_{xyxx} & M_{xyzz} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$M_{xxyy} = M_{dxy}^{(1)} + 2M_{dxy}^{(2)} + M_{dxy}^{(3)} - 2M_{dxy}^{(5)} - M_{gbz}^{(1)} + 2T_{fbz}^{(1)} + T_{fbz}^{(2)}$$

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

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

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

$$M_{yzzz} = M_{dxy}^{(2)} + M_{dxy}^{(5)} + 2M_{gbz}^{(1)} + T_{fbz}^{(2)}$$

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

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

* Rank 4 tensor (a).

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

$$M_{yzzx} = 2M_{dxy}^{(4)} + M_{dxy}^{(6)} + T_{fbz}^{(3)}$$

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

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

* Rank 4 tensor (t).

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

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

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

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

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

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