MPG No. 13.5.130 $4'm'm$ (4'mm' setting) [Type III, tetragonal] [M tensor]

* Rank 0 tensor. * Rank 1 tensor. * Rank 2 tensor (s).

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

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

* Rank 2 tensor (a). * Rank 3 tensor (s).

$$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \\ M_{yzx} & 0 & 0 \\ 0 & M_{yzx} & 0 \\ 0 & 0 & M_{xyz} \end{bmatrix}$$

$$M_{yzx} = M^{(1)}_{f3} - T^{(1)}_{dv}$$
$$M_{xyz} = M^{(1)}_{f3} + 2T^{(1)}_{dv}$$

* Rank 3 tensor (a).

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

$$M_{yzx} = T^{(2)}_{dv}$$

* Rank 4 tensor (sss).

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

$$M_{xxxy} = M^{(1)}_{dxy} + 2M^{(2)}_{dxy} - M^{(1)}_{gbz}$$
$$M_{zzxy} = M^{(1)}_{dxy} + 2M^{(1)}_{gbz}$$
$$M_{yzzx} = M^{(2)}_{dxy} + 2M^{(1)}_{gbz}$$

* Rank 4 tensor (ssa).

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

$$M_{xxxy} = M^{(3)}_{dxy} + 2T^{(1)}_{fbz}$$
$$M_{zzxy} = M^{(3)}_{dxy} - 4T^{(1)}_{fbz}$$

* Rank 4 tensor (aas).

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

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

* Rank 4 tensor (aaa). * Rank 4 tensor (sa).

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

$$M_{xxxy} = -2M^{(5)}_{dxy} + T^{(2)}_{fbz}$$
$$M_{yzzx} = -M^{(5)}_{dxy} - T^{(2)}_{fbz}$$

* Rank 4 tensor (as).

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

$$M_{yzzx} = M^{(6)}_{dxy} + T^{(3)}_{fbz}$$
$$M_{xyxx} = -2M^{(6)}_{dxy} + T^{(3)}_{fbz}$$

* Rank 4 tensor (s).

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

$$M_{xxxy} = M^{(1)}_{dxy} + 2M^{(2)}_{dxy} + M^{(3)}_{dxy} - 2M^{(5)}_{dxy} - M^{(1)}_{gbz} + 2T^{(1)}_{fbz} + T^{(2)}_{fbz}$$
$$M_{xxyx} = M^{(1)}_{dxy} + 2M^{(2)}_{dxy} + M^{(3)}_{dxy} + 2M^{(5)}_{dxy} - M^{(1)}_{gbz} + 2T^{(1)}_{fbz} - T^{(2)}_{fbz}$$
$$M_{zzxy} = M^{(1)}_{dxy} + M^{(3)}_{dxy} + 2M^{(1)}_{gbz} - 4T^{(1)}_{fbz}$$
$$M_{yzzx} = M^{(2)}_{dxy} - M^{(5)}_{dxy} + 2M^{(1)}_{gbz} - T^{(2)}_{fbz}$$
$$M_{yzxz} = M^{(2)}_{dxy} + M^{(5)}_{dxy} + 2M^{(1)}_{gbz} + T^{(2)}_{fbz}$$
$$M_{xyxx} = M^{(1)}_{dxy} + 2M^{(2)}_{dxy} - M^{(3)}_{dxy} - M^{(1)}_{gbz} - 2T^{(1)}_{fbz}$$
$$M_{xyzz} = M^{(1)}_{dxy} - M^{(3)}_{dxy} + 2M^{(1)}_{gbz} + 4T^{(1)}_{fbz}$$

* Rank 4 tensor (a).

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

$$M_{yzzx} = 2M^{(4)}_{dxy} + M^{(6)}_{dxy} + T^{(3)}_{fbz}$$
$$M_{yzxz} = -2M^{(4)}_{dxy} + M^{(6)}_{dxy} + T^{(3)}_{fbz}$$
$$M_{xyxx} = -2M^{(6)}_{dxy} + T^{(3)}_{fbz}$$

* Rank 4 tensor (t).

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

$$\begin{aligned} M_{xxxy} &= M_{dxy}^{(1)} + 2M_{dxy}^{(2)} + M_{dxy}^{(3)} - 2M_{dxy}^{(5)} - M_{gbz}^{(1)} \\ M_{zzxy} &= M_{dxy}^{(1)} + M_{dxy}^{(3)} + 2M_{gbz}^{(1)} \\ M_{xxyx} &= M_{dxy}^{(1)} + 2M_{dxy}^{(2)} + M_{dxy}^{(3)} + 2M_{dxy}^{(5)} - M_{gbz}^{(1)} \\ M_{yzzx} &= M_{dxy}^{(2)} - M_{dxy}^{(5)} + 2M_{gbz}^{(1)} \\ M_{xyyy} &= M_{dxy}^{(1)} + 2M_{dxy}^{(2)} - M_{dxy}^{(3)} - M_{gbz}^{(1)} \end{aligned}$$