

MPG No. 12.3.42 4'22' (4'22' setting) [ Type III, tetragonal ] [M tensor]

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

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

$$M_{xx} = M_{dv}^{(1)}$$

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

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

$$M_{yzz} = M_{f3}^{(1)} - T_{dv}^{(1)}$$

$$M_{xyz} = M_{f3}^{(1)} + 2T_{dv}^{(1)}$$

\* Rank 3 tensor (a).

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

$$M_{yzz} = T_{dv}^{(2)}$$

\* Rank 4 tensor (sss).

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

$$M_{xxxx} = 2M_{dv}^{(1)} + 4M_{dv}^{(2)} + M_{gv}^{(1)}$$

$$M_{xxzz} = M_{dv}^{(1)} - M_{gv}^{(1)}$$

$$M_{yzyz} = -M_{dv}^{(2)} + M_{gv}^{(1)}$$

\* Rank 4 tensor (ssa).

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

$$M_{xxyy} = -2M_{dv}^{(3)} + 4T_{f3}^{(1)}$$

$$M_{xxzz} = -M_{dv}^{(3)} - 4T_{f3}^{(1)}$$

\* Rank 4 tensor (aas).

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

$$M_{yzyz} = 2M_{dv}^{(4)}$$

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

$$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \\ M_{yzyz} & 0 & 0 \\ 0 & M_{yzyz} & 0 \\ 0 & 0 & M_{xyxy} \end{bmatrix}$$

$$\begin{aligned} M_{yzyz} &= -M_{dv}^{(5)} + T_{f3}^{(2)} \\ M_{xyxy} &= 2M_{dv}^{(5)} + T_{f3}^{(2)} \end{aligned}$$

\* Rank 4 tensor (as).

$$\begin{bmatrix} 0 & 0 & 0 & M_{yzyz} & 0 & 0 \\ 0 & 0 & 0 & 0 & M_{yzyz} & 0 \\ 0 & 0 & 0 & 0 & 0 & M_{xyxy} \end{bmatrix}$$

$$\begin{aligned} M_{yzyz} &= -M_{dv}^{(6)} + T_{f3}^{(3)} \\ M_{xyxy} &= 2M_{dv}^{(6)} + T_{f3}^{(3)} \end{aligned}$$

\* Rank 4 tensor (s).

$$\begin{bmatrix} M_{xxxx} & M_{xxyy} & M_{xxzz} & 0 & 0 & 0 & 0 & 0 & 0 \\ -M_{xxyy} & -M_{xxxx} & -M_{xxzz} & 0 & 0 & 0 & 0 & 0 & 0 \\ M_{zzxx} & -M_{zzxx} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & M_{yzyz} & 0 & 0 & M_{yzyz} & 0 & 0 \\ 0 & 0 & 0 & 0 & -M_{yzyz} & 0 & 0 & -M_{yzyz} & 0 \\ 0 & 0 & 0 & 0 & 0 & M_{xyxy} & 0 & 0 & -M_{xyxy} \end{bmatrix}$$

$$M_{xxxx} = 2M_{dv}^{(1)} + 4M_{dv}^{(2)} + M_{gv}^{(1)}$$

$$M_{xxyy} = -2M_{dv}^{(3)} + 4T_{f3}^{(1)}$$

$$M_{xxzz} = M_{dv}^{(1)} - M_{dv}^{(3)} - M_{gv}^{(1)} - 4T_{f3}^{(1)}$$

$$M_{zzxx} = M_{dv}^{(1)} + M_{dv}^{(3)} - M_{gv}^{(1)} + 4T_{f3}^{(1)}$$

$$M_{yzyz} = -M_{dv}^{(2)} - M_{dv}^{(5)} + M_{gv}^{(1)} + T_{f3}^{(2)}$$

$$M_{yzyz} = -M_{dv}^{(2)} + M_{dv}^{(5)} + M_{gv}^{(1)} - T_{f3}^{(2)}$$

$$M_{xyxy} = 2M_{dv}^{(5)} + T_{f3}^{(2)}$$

\* Rank 4 tensor (a).

$$\begin{bmatrix} 0 & 0 & 0 & M_{yzyz} & 0 & 0 & M_{yzyz} & 0 & 0 \\ 0 & 0 & 0 & 0 & M_{yzyz} & 0 & 0 & M_{yzyz} & 0 \\ 0 & 0 & 0 & 0 & 0 & M_{xyxy} & 0 & 0 & M_{xyxy} \end{bmatrix}$$

$$M_{yzyz} = 2M_{dv}^{(4)} - M_{dv}^{(6)} + T_{f3}^{(3)}$$

$$M_{yzyz} = -2M_{dv}^{(4)} - M_{dv}^{(6)} + T_{f3}^{(3)}$$

$$M_{xyxy} = 2M_{dv}^{(6)} + T_{f3}^{(3)}$$

\* Rank 4 tensor (t).

$$\begin{bmatrix} M_{xxxx} & 0 & 0 \\ 0 & -M_{xxxx} & 0 \\ 0 & 0 & 0 \\ 0 & 0 & M_{yyzz} \\ M_{zxxx} & 0 & 0 \\ 0 & -M_{yyzz} - M_{zxxx} & 0 \\ 0 & M_{yzyy} & 0 \\ 0 & 0 & M_{zxzx} \\ -M_{yzyy} - M_{zxzx} & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$M_{xxxx} = 2M_{dv}^{(1)} + 4M_{dv}^{(2)} + M_{gv}^{(1)}$$

$$M_{yyzz} = -M_{dv}^{(1)} + M_{dv}^{(3)} + M_{gv}^{(1)}$$

$$M_{zxxx} = M_{dv}^{(1)} + M_{dv}^{(3)} - M_{gv}^{(1)}$$

$$M_{yzyy} = -M_{dv}^{(2)} + M_{dv}^{(5)} + M_{gv}^{(1)}$$

$$M_{zxzx} = M_{dv}^{(2)} + M_{dv}^{(5)} - M_{gv}^{(1)}$$