

MPG No. 7.4.23 $m'm'2$ [Type III, orthorhombic] [T tensor]

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

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

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

* Rank 2 tensor (a).

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

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

* Rank 3 tensor (s).

$$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \\ T_{yzz} & 0 & 0 \\ 0 & T_{zxy} & 0 \\ 0 & 0 & T_{xyz} \end{bmatrix}$$

$$T_{yzz} = -3M_{du}^{(1)} - M_{dv}^{(1)} + T_{f3}^{(1)}$$

$$T_{zxy} = 3M_{du}^{(1)} - M_{dv}^{(1)} + T_{f3}^{(1)}$$

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

* Rank 3 tensor (a).

$$\begin{bmatrix} T_{yzz} & 0 & 0 \\ 0 & T_{zxy} & 0 \\ 0 & 0 & T_{xyz} \end{bmatrix}$$

$$T_{yzz} = -M_{du}^{(2)} + M_{dv}^{(2)} + M_s^{(1)}$$

$$T_{zxy} = -M_{du}^{(2)} - M_{dv}^{(2)} + M_s^{(1)}$$

$$T_{xyz} = 2M_{du}^{(2)} + M_s^{(1)}$$

* Rank 4 tensor (sss).

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

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

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

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

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

* Rank 4 tensor (ssa).

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & T_{xxyy} \\ 0 & 0 & 0 & 0 & 0 & T_{yyxy} \\ 0 & 0 & 0 & 0 & 0 & T_{zzxy} \\ 0 & 0 & 0 & 0 & 0 & T_{yzzx} \\ 0 & 0 & 0 & -T_{yzzx} & 0 & 0 \\ -T_{xxyy} & -T_{yyxy} & -T_{zzxy} & 0 & 0 & 0 \end{bmatrix}$$

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

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

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

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

* Rank 4 tensor (aas).

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

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

* Rank 4 tensor (aaa).

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

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

* Rank 4 tensor (sa).

$$\begin{bmatrix} 0 & 0 & T_{xxyy} \\ 0 & 0 & T_{yyxy} \\ 0 & 0 & T_{zzxy} \\ 0 & T_{yzzx} & 0 \\ T_{zxyz} & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

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

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

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

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

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

* Rank 4 tensor (as).

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

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

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

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

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

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

* Rank 4 tensor (s).

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & T_{xxxy} & 0 & 0 & T_{xxyx} \\ 0 & 0 & 0 & 0 & 0 & T_{yyxy} & 0 & 0 & T_{yyyx} \\ 0 & 0 & 0 & 0 & 0 & T_{zzxy} & 0 & 0 & T_{zzyx} \\ 0 & 0 & 0 & 0 & T_{yzzx} & 0 & 0 & T_{yxxz} & 0 \\ 0 & 0 & 0 & T_{zxyz} & 0 & 0 & T_{zxzy} & 0 & 0 \\ T_{xyxx} & T_{xyyy} & T_{xyzz} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$\begin{aligned} T_{xxxy} &= -2M_{faz}^{(1)} - M_{faz}^{(2)} + 2M_{fbz}^{(1)} + M_{fbz}^{(2)} + 2M_{pz}^{(1)} + M_{pz}^{(3)} + T_{dxy}^{(1)} + 2T_{dxy}^{(2)} + T_{dxy}^{(3)} - 2T_{dxy}^{(5)} + T_{gaz}^{(1)} - T_{gbz}^{(1)} \\ T_{xxyx} &= -2M_{faz}^{(1)} + M_{faz}^{(2)} + 2M_{fbz}^{(1)} - M_{fbz}^{(2)} + 2M_{pz}^{(1)} - M_{pz}^{(3)} + T_{dxy}^{(1)} + 2T_{dxy}^{(2)} + T_{dxy}^{(3)} + 2T_{dxy}^{(5)} + T_{gaz}^{(1)} - T_{gbz}^{(1)} \\ T_{yyxy} &= 2M_{faz}^{(1)} - M_{faz}^{(2)} + 2M_{fbz}^{(1)} - M_{fbz}^{(2)} - 2M_{pz}^{(1)} + M_{pz}^{(3)} + T_{dxy}^{(1)} + 2T_{dxy}^{(2)} + T_{dxy}^{(3)} + 2T_{dxy}^{(5)} - T_{gaz}^{(1)} - T_{gbz}^{(1)} \\ T_{yyyx} &= 2M_{faz}^{(1)} + M_{faz}^{(2)} + 2M_{fbz}^{(1)} + M_{fbz}^{(2)} - 2M_{pz}^{(1)} - M_{pz}^{(3)} + T_{dxy}^{(1)} + 2T_{dxy}^{(2)} + T_{dxy}^{(3)} - 2T_{dxy}^{(5)} - T_{gaz}^{(1)} - T_{gbz}^{(1)} \\ T_{zzxy} &= 2M_{faz}^{(2)} - 4M_{fbz}^{(1)} + M_{pz}^{(3)} + 2M_{pz}^{(4)} + T_{dxy}^{(1)} + T_{dxy}^{(3)} + 2T_{gbz}^{(1)} \\ T_{zzyx} &= -2M_{faz}^{(2)} - 4M_{fbz}^{(1)} - M_{pz}^{(3)} - 2M_{pz}^{(4)} + T_{dxy}^{(1)} + T_{dxy}^{(3)} + 2T_{gbz}^{(1)} \\ T_{yzzx} &= -4M_{faz}^{(1)} - M_{faz}^{(2)} - M_{fbz}^{(1)} - M_{fbz}^{(2)} - M_{pz}^{(1)} + M_{pz}^{(4)} + T_{dxy}^{(2)} - T_{dxy}^{(5)} + 2T_{gbz}^{(1)} \\ T_{yzxz} &= -4M_{faz}^{(1)} + M_{faz}^{(2)} + M_{fbz}^{(1)} - M_{fbz}^{(2)} - M_{pz}^{(1)} - M_{pz}^{(4)} + T_{dxy}^{(2)} + T_{dxy}^{(5)} + 2T_{gbz}^{(1)} \\ T_{zxyz} &= 4M_{faz}^{(1)} - M_{faz}^{(2)} + M_{fbz}^{(1)} + M_{pz}^{(1)} + M_{pz}^{(4)} + T_{dxy}^{(2)} + T_{dxy}^{(5)} + 2T_{gbz}^{(1)} \\ T_{zxzy} &= 4M_{faz}^{(1)} + M_{faz}^{(2)} - M_{fbz}^{(1)} + M_{pz}^{(1)} - M_{pz}^{(4)} + T_{dxy}^{(2)} - T_{dxy}^{(5)} + 2T_{gbz}^{(1)} \\ T_{xyxx} &= 2M_{faz}^{(1)} - 2M_{fbz}^{(1)} - 2M_{pz}^{(1)} + T_{dxy}^{(1)} + 2T_{dxy}^{(2)} - T_{dxy}^{(3)} + T_{gaz}^{(1)} - T_{gbz}^{(1)} \\ T_{xyyy} &= -2M_{faz}^{(1)} - 2M_{fbz}^{(1)} + 2M_{pz}^{(1)} + T_{dxy}^{(1)} + 2T_{dxy}^{(2)} - T_{dxy}^{(3)} - T_{gaz}^{(1)} - T_{gbz}^{(1)} \\ T_{xyzz} &= 4M_{fbz}^{(1)} + T_{dxy}^{(1)} - T_{dxy}^{(3)} + 2T_{gbz}^{(1)} \end{aligned}$$

* Rank 4 tensor (a).

$$\begin{bmatrix} 0 & 0 & 0 & 0 & T_{yzzx} & 0 & 0 & T_{yxxz} & 0 \\ 0 & 0 & 0 & T_{zxyz} & 0 & 0 & T_{zxzy} & 0 & 0 \\ T_{xyxx} & T_{xyyy} & T_{xyzz} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$\begin{aligned} T_{yzzx} &= -M_{faz}^{(3)} + M_{fbz}^{(3)} - M_{pz}^{(2)} + M_{pz}^{(6)} + 2T_{dxy}^{(4)} + T_{dxy}^{(6)} \\ T_{yxxz} &= -M_{faz}^{(3)} + M_{fbz}^{(3)} + M_{pz}^{(2)} + M_{pz}^{(6)} - 2T_{dxy}^{(4)} + T_{dxy}^{(6)} \\ T_{zxyz} &= -M_{faz}^{(3)} - M_{fbz}^{(3)} + M_{pz}^{(2)} + M_{pz}^{(6)} + 2T_{dxy}^{(4)} - T_{dxy}^{(6)} \\ T_{zxzy} &= -M_{faz}^{(3)} - M_{fbz}^{(3)} - M_{pz}^{(2)} + M_{pz}^{(6)} - 2T_{dxy}^{(4)} - T_{dxy}^{(6)} \\ T_{xyxx} &= -M_{faz}^{(3)} + M_{fbz}^{(3)} + M_{pz}^{(5)} - 2T_{dxy}^{(6)} \\ T_{xyyy} &= -M_{faz}^{(3)} - M_{fbz}^{(3)} + M_{pz}^{(5)} + 2T_{dxy}^{(6)} \\ T_{xyzz} &= 2M_{faz}^{(3)} + M_{pz}^{(5)} + 2M_{pz}^{(6)} \end{aligned}$$

* Rank 4 tensor (t).

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

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

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

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

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

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

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