

MPG No. 13.1.44 4mm [ Type I, tetragonal ] [T tensor]

\* Rank 0 tensor.

$$[T]$$

$$T = T_s^{(1)}$$

\* Rank 1 tensor.

$$[0 \quad 0 \quad T_z]$$

$$T_z = T_{pz}^{(1)}$$

\* Rank 2 tensor (s).

$$\begin{bmatrix} T_{xx} & 0 & 0 \\ 0 & T_{xx} & 0 \\ 0 & 0 & T_{zz} \end{bmatrix}$$

$$T_{xx} = -T_{du}^{(1)} + T_s^{(1)}$$

$$T_{zz} = 2T_{du}^{(1)} + T_s^{(1)}$$

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

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

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

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

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

\* Rank 3 tensor (a).

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

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

\* Rank 4 tensor (sss).

$$\begin{bmatrix} T_{xxxx} & T_{xxyy} & T_{xxzz} & 0 & 0 & 0 \\ T_{xxyy} & T_{xxxx} & T_{xxzz} & 0 & 0 & 0 \\ T_{xxzz} & T_{xxzz} & T_{zzzz} & 0 & 0 & 0 \\ 0 & 0 & 0 & T_{yzyz} & 0 & 0 \\ 0 & 0 & 0 & 0 & T_{yzyz} & 0 \\ 0 & 0 & 0 & 0 & 0 & T_{xyxy} \end{bmatrix}$$

$$T_{xxxx} = -2T_{du}^{(1)} - 4T_{du}^{(2)} - T_{gu}^{(1)} + 2T_g^{(1)} + T_s^{(1)} + 2T_s^{(2)}$$

$$T_{xxyy} = -2T_{du}^{(1)} + 2T_{gu}^{(1)} - T_g^{(1)} + T_s^{(1)}$$

$$T_{xxzz} = T_{du}^{(1)} - T_{gu}^{(1)} - T_g^{(1)} + T_s^{(1)}$$

$$T_{zzzz} = 4T_{du}^{(1)} + 8T_{du}^{(2)} + 2T_{gu}^{(1)} + 2T_g^{(1)} + T_s^{(1)} + 2T_s^{(2)}$$

$$T_{yzyz} = T_{du}^{(2)} - T_{gu}^{(1)} - T_g^{(1)} + T_s^{(2)}$$

$$T_{xyxy} = -2T_{du}^{(2)} + 2T_{gu}^{(1)} - T_g^{(1)} + T_s^{(2)}$$

\* Rank 4 tensor (ssa).

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

$$T_{xxzz} = 3T_{du}^{(3)}$$

\* Rank 4 tensor (aas).

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

$$T_{yzyz} = -2T_{du}^{(4)} + T_s^{(3)}$$

$$T_{xyxy} = 4T_{du}^{(4)} + T_s^{(3)}$$

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

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

$$T_{yzyz} = -3T_{du}^{(5)}$$

\* Rank 4 tensor (as).

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

$$T_{yzyz} = -3T_{du}^{(6)}$$

\* Rank 4 tensor (s).

$$\begin{bmatrix} T_{xxxx} & T_{xxyy} & T_{xxxx} & 0 & 0 & 0 & 0 & 0 & 0 \\ T_{xxyy} & T_{xxxx} & T_{xxxx} & 0 & 0 & 0 & 0 & 0 & 0 \\ T_{zzxx} & T_{zzxx} & T_{zzxx} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & T_{yzyz} & 0 & 0 & T_{yzyz} & 0 & 0 \\ 0 & 0 & 0 & 0 & T_{yzyz} & 0 & 0 & T_{yzyz} & 0 \\ 0 & 0 & 0 & 0 & 0 & T_{xyxy} & 0 & 0 & T_{xyxy} \end{bmatrix}$$

$$T_{xxxx} = -2T_{du}^{(1)} - 4T_{du}^{(2)} - T_{gu}^{(1)} + 2T_g^{(1)} + T_s^{(1)} + 2T_s^{(2)}$$

$$T_{xxyy} = -2T_{du}^{(1)} + 2T_{gu}^{(1)} - T_g^{(1)} + T_s^{(1)}$$

$$T_{xxzz} = T_{du}^{(1)} + 3T_{du}^{(3)} - T_{gu}^{(1)} - T_g^{(1)} + T_s^{(1)}$$

$$T_{zzxx} = T_{du}^{(1)} - 3T_{du}^{(3)} - T_{gu}^{(1)} - T_g^{(1)} + T_s^{(1)}$$

$$T_{zzzz} = 4T_{du}^{(1)} + 8T_{du}^{(2)} + 2T_{gu}^{(1)} + 2T_g^{(1)} + T_s^{(1)} + 2T_s^{(2)}$$

$$T_{yzyz} = T_{du}^{(2)} - 3T_{du}^{(5)} - T_{gu}^{(1)} - T_g^{(1)} + T_s^{(2)}$$

$$T_{yzyy} = T_{du}^{(2)} + 3T_{du}^{(5)} - T_{gu}^{(1)} - T_g^{(1)} + T_s^{(2)}$$

$$T_{xyxy} = -2T_{du}^{(2)} + 2T_{gu}^{(1)} - T_g^{(1)} + T_s^{(2)}$$

\* Rank 4 tensor (a).

$$\begin{bmatrix} 0 & 0 & 0 & T_{yzyz} & 0 & 0 & T_{yzyy} & 0 & 0 \\ 0 & 0 & 0 & 0 & -T_{yzyy} & 0 & 0 & -T_{yzyz} & 0 \\ 0 & 0 & 0 & 0 & 0 & T_{xyxy} & 0 & 0 & -T_{xyxy} \end{bmatrix}$$

$$T_{yzyz} = -2T_{du}^{(4)} - 3T_{du}^{(6)} + T_s^{(3)}$$

$$T_{yzyy} = 2T_{du}^{(4)} - 3T_{du}^{(6)} - T_s^{(3)}$$

$$T_{xyxy} = 4T_{du}^{(4)} + T_s^{(3)}$$

\* Rank 4 tensor (t).

$$\begin{bmatrix} T_{xxxx} & 0 & 0 \\ 0 & T_{xxxx} & 0 \\ 0 & 0 & T_{zzzz} \\ 0 & 0 & T_{yyzz} \\ T_{zzxx} & 0 & 0 \\ 0 & T_{xxyy} & 0 \\ 0 & T_{yzyy} & 0 \\ 0 & 0 & T_{zxxx} \\ T_{xxyy} + T_{yyzz} - T_{yzyy} - T_{zxxx} + T_{zzxx} & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$T_{xxxx} = -2T_{du}^{(1)} - 4T_{du}^{(2)} - T_{gu}^{(1)} + 2T_g^{(1)} + 3T_s^{(1)}$$

$$T_{zzzz} = 4T_{du}^{(1)} + 8T_{du}^{(2)} + 2T_{gu}^{(1)} + 2T_g^{(1)} + 3T_s^{(1)}$$

$$T_{yyzz} = T_{du}^{(1)} + 3T_{du}^{(3)} - T_{gu}^{(1)} - T_g^{(1)} + T_s^{(1)}$$

$$T_{zzxx} = T_{du}^{(1)} - 3T_{du}^{(3)} - T_{gu}^{(1)} - T_g^{(1)} + T_s^{(1)}$$

$$T_{xxyy} = -2T_{du}^{(1)} + 2T_{gu}^{(1)} - T_g^{(1)} + T_s^{(1)}$$

$$T_{yzyy} = T_{du}^{(2)} + 3T_{du}^{(5)} - T_{gu}^{(1)} - T_g^{(1)} + T_s^{(1)}$$

$$T_{zxxx} = T_{du}^{(2)} - 3T_{du}^{(5)} - T_{gu}^{(1)} - T_g^{(1)} + T_s^{(1)}$$