

MPG No. 6.4.123 2'2'2 (22'2' setting) [Type III, orthorhombic] [M tensor]

* Rank 0 tensor. * Rank 1 tensor.

$$[M_x \ 0 \ 0]$$

$$M_x = M_{px}^{(1)}$$

* Rank 2 tensor (s).

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

$$M_{yz} = M_{dyz}^{(1)}$$

* Rank 2 tensor (a).

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

$$M_{yz} = T_{px}^{(1)}$$

* Rank 3 tensor (s).

$$\begin{bmatrix} M_{xxx} & 0 & 0 \\ M_{yyx} & 0 & 0 \\ M_{zzx} & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & M_{zxz} \\ 0 & M_{xyy} & 0 \end{bmatrix}$$

$$M_{xxx} = 2M_{fax}^{(1)} + M_{px}^{(1)} + 2M_{px}^{(2)}$$

$$M_{yyx} = -M_{fax}^{(1)} + M_{fbx}^{(1)} + M_{px}^{(1)} - 2T_{dyz}^{(1)}$$

$$M_{zzx} = -M_{fax}^{(1)} - M_{fbx}^{(1)} + M_{px}^{(1)} + 2T_{dyz}^{(1)}$$

$$M_{zxz} = -M_{fax}^{(1)} - M_{fbx}^{(1)} + M_{px}^{(2)} - T_{dyz}^{(1)}$$

$$M_{xyy} = -M_{fax}^{(1)} + M_{fbx}^{(1)} + M_{px}^{(2)} + T_{dyz}^{(1)}$$

* Rank 3 tensor (a).

$$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & M_{zxz} \\ 0 & M_{xyy} & 0 \end{bmatrix}$$

$$M_{zxz} = M_{px}^{(3)} + T_{dyz}^{(2)}$$

$$M_{xyy} = -M_{px}^{(3)} + T_{dyz}^{(2)}$$

* Rank 4 tensor (sss).

$$\begin{bmatrix} 0 & 0 & 0 & M_{xxyz} & 0 & 0 \\ 0 & 0 & 0 & M_{yyyz} & 0 & 0 \\ 0 & 0 & 0 & M_{zzyz} & 0 & 0 \\ M_{xxyz} & M_{yyyz} & M_{zzyz} & 0 & 0 & M_{zxxy} \\ 0 & 0 & 0 & 0 & 0 & M_{zxxy} \\ 0 & 0 & 0 & 0 & M_{zxxy} & 0 \end{bmatrix}$$

$$\begin{aligned}
M_{xxyz} &= M_{dyz}^{(1)} + 2M_{gbx}^{(1)} \\
M_{yyyz} &= M_{dyz}^{(1)} + 2M_{dyz}^{(2)} + M_{gax}^{(1)} - M_{gbx}^{(1)} \\
M_{zzyz} &= M_{dyz}^{(1)} + 2M_{dyz}^{(2)} - M_{gax}^{(1)} - M_{gbx}^{(1)} \\
M_{zxxz} &= M_{dyz}^{(2)} + 2M_{gbx}^{(1)}
\end{aligned}$$

* Rank 4 tensor (ssa).

$$\begin{bmatrix}
0 & 0 & 0 & M_{xxyz} & 0 & 0 \\
0 & 0 & 0 & M_{yyyz} & 0 & 0 \\
0 & 0 & 0 & M_{zzyz} & 0 & 0 \\
-M_{xxyz} & -M_{yyyz} & -M_{zzyz} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & M_{zxxz} \\
0 & 0 & 0 & 0 & -M_{zxxz} & 0
\end{bmatrix}$$

$$\begin{aligned}
M_{xxyz} &= M_{dyz}^{(3)} - 4T_{fbx}^{(1)} \\
M_{yyyz} &= M_{dyz}^{(3)} - 2T_{fax}^{(1)} + 2T_{fbx}^{(1)} + 2T_{px}^{(1)} \\
M_{zzyz} &= M_{dyz}^{(3)} + 2T_{fax}^{(1)} + 2T_{fbx}^{(1)} - 2T_{px}^{(1)} \\
M_{zxxz} &= -4T_{fax}^{(1)} - T_{px}^{(1)}
\end{aligned}$$

* Rank 4 tensor (aas).

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

$$M_{zxxz} = 2M_{dyz}^{(4)}$$

* Rank 4 tensor (aaa).

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

$$M_{zxxz} = -T_{px}^{(2)}$$

* Rank 4 tensor (sa).

$$\begin{bmatrix}
M_{xxyz} & 0 & 0 \\
M_{yyyz} & 0 & 0 \\
M_{zzyz} & 0 & 0 \\
0 & 0 & 0 \\
0 & 0 & M_{zxxz} \\
0 & M_{xyzx} & 0
\end{bmatrix}$$

$$\begin{aligned}
M_{xxyz} &= 2T_{fax}^{(2)} + T_{px}^{(3)} + 2T_{px}^{(4)} \\
M_{yyyz} &= -2M_{dyz}^{(5)} - T_{fax}^{(2)} + T_{fbx}^{(2)} + T_{px}^{(3)} \\
M_{zzyz} &= 2M_{dyz}^{(5)} - T_{fax}^{(2)} - T_{fbx}^{(2)} + T_{px}^{(3)} \\
M_{zxxz} &= -M_{dyz}^{(5)} - T_{fax}^{(2)} - T_{fbx}^{(2)} + T_{px}^{(4)} \\
M_{xyzx} &= M_{dyz}^{(5)} - T_{fax}^{(2)} + T_{fbx}^{(2)} + T_{px}^{(4)}
\end{aligned}$$

* Rank 4 tensor (as).

$$\begin{bmatrix}
M_{yzxx} & M_{yzyy} & M_{yzzz} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & M_{zxxz} \\
0 & 0 & 0 & 0 & M_{xyzx} & 0
\end{bmatrix}$$

$$\begin{aligned}
M_{yzxx} &= 2T_{fax}^{(3)} + T_{px}^{(5)} + 2T_{px}^{(6)} \\
M_{yzyy} &= -2M_{dyz}^{(6)} - T_{fax}^{(3)} + T_{fbx}^{(3)} + T_{px}^{(5)} \\
M_{yzzz} &= 2M_{dyz}^{(6)} - T_{fax}^{(3)} - T_{fbx}^{(3)} + T_{px}^{(5)} \\
M_{zxxxy} &= M_{dyz}^{(6)} - T_{fax}^{(3)} + T_{fbx}^{(3)} + T_{px}^{(6)} \\
M_{xyzx} &= -M_{dyz}^{(6)} - T_{fax}^{(3)} - T_{fbx}^{(3)} + T_{px}^{(6)}
\end{aligned}$$

* Rank 4 tensor (s).

$$\begin{bmatrix}
0 & 0 & 0 & M_{xxyz} & 0 & 0 & M_{xxzy} & 0 & 0 \\
0 & 0 & 0 & M_{yyyz} & 0 & 0 & M_{yyzy} & 0 & 0 \\
0 & 0 & 0 & M_{zzyz} & 0 & 0 & M_{zzzy} & 0 & 0 \\
M_{yzxx} & M_{yzyy} & M_{yzzz} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & M_{zxxxy} & 0 & 0 & M_{zxyx} \\
0 & 0 & 0 & 0 & M_{xyzx} & 0 & 0 & M_{xyxz} & 0
\end{bmatrix}$$

$$\begin{aligned}
M_{xxyz} &= M_{dyz}^{(1)} + M_{dyz}^{(3)} + 2M_{gbx}^{(1)} + 2T_{fax}^{(2)} - 4T_{fbx}^{(1)} + T_{px}^{(3)} + 2T_{px}^{(4)} \\
M_{xxzy} &= M_{dyz}^{(1)} + M_{dyz}^{(3)} + 2M_{gbx}^{(1)} - 2T_{fax}^{(2)} - 4T_{fbx}^{(1)} - T_{px}^{(3)} - 2T_{px}^{(4)} \\
M_{yyyz} &= M_{dyz}^{(1)} + 2M_{dyz}^{(2)} + M_{dyz}^{(3)} - 2M_{dyz}^{(5)} + M_{gax}^{(1)} - M_{gbx}^{(1)} - 2T_{fax}^{(1)} - T_{fbx}^{(2)} + 2T_{fbx}^{(1)} + 2T_{px}^{(1)} + T_{px}^{(3)} \\
M_{yyzy} &= M_{dyz}^{(1)} + 2M_{dyz}^{(2)} + M_{dyz}^{(3)} + 2M_{dyz}^{(5)} + M_{gax}^{(1)} - M_{gbx}^{(1)} - 2T_{fax}^{(1)} + T_{fbx}^{(2)} + 2T_{fbx}^{(1)} - T_{px}^{(2)} + 2T_{px}^{(1)} - T_{px}^{(3)} \\
M_{zzyz} &= M_{dyz}^{(1)} + 2M_{dyz}^{(2)} + M_{dyz}^{(3)} + 2M_{dyz}^{(5)} - M_{gax}^{(1)} - M_{gbx}^{(1)} + 2T_{fax}^{(1)} - T_{fbx}^{(2)} + 2T_{fbx}^{(1)} - T_{px}^{(2)} - 2T_{px}^{(1)} + T_{px}^{(3)} \\
M_{zzzy} &= M_{dyz}^{(1)} + 2M_{dyz}^{(2)} + M_{dyz}^{(3)} - 2M_{dyz}^{(5)} - M_{gax}^{(1)} - M_{gbx}^{(1)} + 2T_{fax}^{(1)} + T_{fbx}^{(2)} + 2T_{fbx}^{(1)} - 2T_{px}^{(1)} - T_{px}^{(3)} \\
M_{yzxx} &= M_{dyz}^{(1)} - M_{dyz}^{(3)} + 2M_{gbx}^{(1)} + 4T_{fbx}^{(1)} \\
M_{yzyy} &= M_{dyz}^{(1)} + 2M_{dyz}^{(2)} - M_{dyz}^{(3)} + M_{gax}^{(1)} - M_{gbx}^{(1)} + 2T_{fax}^{(1)} - 2T_{fbx}^{(1)} - 2T_{px}^{(1)} \\
M_{yzzz} &= M_{dyz}^{(1)} + 2M_{dyz}^{(2)} - M_{dyz}^{(3)} - M_{gax}^{(1)} - M_{gbx}^{(1)} - 2T_{fax}^{(1)} - 2T_{fbx}^{(1)} + 2T_{px}^{(1)} \\
M_{zxxxy} &= M_{dyz}^{(2)} - M_{dyz}^{(5)} + 2M_{gbx}^{(1)} - 4T_{fax}^{(1)} - T_{fbx}^{(2)} - T_{px}^{(1)} + T_{px}^{(4)} \\
M_{zxyx} &= M_{dyz}^{(2)} + M_{dyz}^{(5)} + 2M_{gbx}^{(1)} - 4T_{fax}^{(1)} + T_{fbx}^{(2)} + T_{fbx}^{(1)} - T_{px}^{(1)} - T_{px}^{(4)} \\
M_{xyzx} &= M_{dyz}^{(2)} + M_{dyz}^{(5)} + 2M_{gbx}^{(1)} + 4T_{fax}^{(1)} - T_{fbx}^{(2)} + T_{px}^{(1)} + T_{px}^{(4)} \\
M_{xyxz} &= M_{dyz}^{(2)} - M_{dyz}^{(5)} + 2M_{gbx}^{(1)} + 4T_{fax}^{(1)} + T_{fbx}^{(2)} - T_{px}^{(1)} + T_{px}^{(1)} - T_{px}^{(4)}
\end{aligned}$$

* Rank 4 tensor (a).

$$\begin{bmatrix}
M_{yzxx} & M_{yzyy} & M_{yzzz} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & M_{zxxxy} & 0 & 0 & M_{zxyx} \\
0 & 0 & 0 & 0 & M_{xyzx} & 0 & 0 & M_{xyxz} & 0
\end{bmatrix}$$

$$\begin{aligned}
M_{yzxx} &= 2T_{fax}^{(3)} + T_{px}^{(5)} + 2T_{px}^{(6)} \\
M_{yzyy} &= -2M_{dyz}^{(6)} - T_{fax}^{(3)} + T_{fbx}^{(3)} + T_{px}^{(5)} \\
M_{yzzz} &= 2M_{dyz}^{(6)} - T_{fax}^{(3)} - T_{fbx}^{(3)} + T_{px}^{(5)} \\
M_{zxxxy} &= 2M_{dyz}^{(4)} + M_{dyz}^{(6)} - T_{fax}^{(3)} + T_{fbx}^{(3)} - T_{px}^{(2)} + T_{px}^{(6)} \\
M_{zxyx} &= -2M_{dyz}^{(4)} + M_{dyz}^{(6)} - T_{fax}^{(3)} + T_{fbx}^{(3)} + T_{px}^{(2)} + T_{px}^{(6)} \\
M_{xyzx} &= 2M_{dyz}^{(4)} - M_{dyz}^{(6)} - T_{fax}^{(3)} - T_{fbx}^{(3)} + T_{px}^{(2)} + T_{px}^{(6)} \\
M_{xyxz} &= -2M_{dyz}^{(4)} - M_{dyz}^{(6)} - T_{fax}^{(3)} - T_{fbx}^{(3)} - T_{px}^{(2)} + T_{px}^{(6)}
\end{aligned}$$

* Rank 4 tensor (t).

$$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & M_{yyyz} \\ 0 & M_{zzzy} & 0 \\ 0 & M_{yyzy} & 0 \\ 0 & 0 & 0 \\ 0 & 0 & M_{xxyz} \\ 0 & 0 & M_{yzzz} \\ 0 & M_{zxxy} & 0 \\ 0 & 0 & 0 \\ -\frac{M_{yyuz}}{2} + \frac{M_{uyzu}}{2} + M_{zxxy} & 0 & 0 \end{bmatrix}$$

$$M_{yyyz} = M_{dyz}^{(1)} + 2M_{dyz}^{(2)} + M_{dyz}^{(3)} - 2M_{dyz}^{(5)} + M_{gax}^{(1)} - M_{gbx}^{(1)}$$

$$M_{zzzy} = M_{dyz}^{(1)} + 2M_{dyz}^{(2)} + M_{dyz}^{(3)} - 2M_{dyz}^{(5)} - M_{gax}^{(1)} - M_{gbx}^{(1)}$$

$$M_{yyzy} = M_{dyz}^{(1)} + 2M_{dyz}^{(2)} + M_{dyz}^{(3)} + 2M_{dyz}^{(5)} + M_{gax}^{(1)} - M_{gbx}^{(1)}$$

$$M_{xxyz} = M_{dyz}^{(1)} + M_{dyz}^{(3)} + 2M_{gbx}^{(1)}$$

$$M_{yzzz} = M_{dyz}^{(1)} + 2M_{dyz}^{(2)} - M_{dyz}^{(3)} - M_{gax}^{(1)} - M_{gbx}^{(1)}$$

$$M_{zxxy} = M_{dyz}^{(2)} - M_{dyz}^{(5)} + 2M_{gbx}^{(1)}$$