$$\begin{pmatrix} \sigma_{xx} & \sigma_{xy} \\ \sigma_{yx} & \sigma_{yy} \end{pmatrix} = \hat{U}_{180}\hat{\sigma}\hat{U}_{180} = (-1)\begin{pmatrix} \sigma_{xx} & \sigma_{xy} \\ \sigma_{yx} & \sigma_{yy} \end{pmatrix}(-1)$$
$$= \begin{pmatrix} \sigma_{xx} & \sigma_{xy} \\ \sigma_{yx} & \sigma_{yy} \end{pmatrix} \tag{6}$$

$\Rightarrow$ lattice symmetry imposes no constrains on $\hat{\sigma}$.

Time-reversal symmetry

(symmetry of Onsager kinetic coefficients):

$$\sigma_{ij} = \sigma_{ji} \Rightarrow \tag{7}$$

$$\hat{\sigma}_{\text{oblique}} = \begin{pmatrix} \sigma_{xx} & \sigma_{xy} \\ \sigma_{xy} & \sigma_{yy} \end{pmatrix} \tag{8}$$