



TABLES DE CARACTERES

C_s	E	$\sigma(xy)$		
A'	+1	+1	T_x, T_y, R_z	$\alpha_{xx}, \alpha_{yy}, \alpha_{zz}, \alpha_{xy}$
A''	+1	-1	T_z, R_x, R_y	α_{yz}, α_{xz}

C_2	E	$C_2(z)$		
A	+1	+1	T_z, R_z	$\alpha_{xx}, \alpha_{yy}, \alpha_{zz}, \alpha_{xy}$
B	+1	-1	T_x, T_y, R_x, R_y	α_{yz}, α_{xz}

C_i	E	i		
A_g	+1	+1	R_x, R_y, R_z	All components of α
A_u	+1	-1	T_x, T_y, T_z	

C_{2v}	E	$C_2(z)$	$\sigma_v(xz)$	$\sigma_v(yz)$		
A_1	+1	+1	+1	+1	T_z	$\alpha_{xx}, \alpha_{yy}, \alpha_{zz}$
A_2	+1	+1	-1	-1	R_z	α_{xy}
B_1	+1	-1	+1	-1	T_x, R_y	α_{xz}
B_2	+1	-1	-1	+1	T_y, R_x	α_{yz}

C_{3v}	E	$2C_3(z)$	$3\sigma_v$		
A_1	+1	+1	+1	T_z	$\alpha_{xx} + \alpha_{yy}, \alpha_{zz}$
A_2	+1	+1	-1	R_z	
E	+2	-1	0	$(T_x, T_y), (R_x, R_y)$	$(\alpha_{xx} - \alpha_{yy}, \alpha_{xy}), (\alpha_{yz}, \alpha_{xz})$

C_{4v}	E	$2C_4(z)$	$C_4^2 \equiv C_2$	$2\sigma_v$	$2\sigma_d$		
A_1	+1	+1	+1	+1	+1	T_z	$\alpha_{xx} + \alpha_{yy}, \alpha_{zz}$
A_2	+1	+1	+1	-1	-1	R_z	
B_1	+1	-1	+1	+1	-1		$\alpha_{xx} - \alpha_{yy}$
B_2	+1	-1	+1	-1	+1		α_{xy}
E	+2	0	-2	0	0	$(T_x, T_y), (R_x, R_y)$	$(\alpha_{yz}, \alpha_{xz})$

C_p^n (or S_p^n) denotes that C_p (or S_p) operation is carried out successively n times

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$C_{\infty v}$	E	$2C_{\infty}^{\phi}$	$2C_{\infty}^{2\phi}$	$2C_{\infty}^{3\phi}$...	$\infty\sigma_v$		
Σ^+	+1	+1	+1	+1	...	+1	T_z	$\alpha_{xx} + \alpha_{yy}, \alpha_{zz}$
Σ^-	+1	+1	+1	+1	...	-1	R_z	
Π	+2	$2 \cos \phi$	$2 \cos 2\phi$	$2 \cos 3\phi$...	0	$(T_x, T_y), (R_x, R_y)$	$(\alpha_{yz}, \alpha_{xz})$
Δ	+2	$2 \cos 2\phi$	$2 \cos 2.2\phi$	$2 \cos 3.2\phi$	...	0		$(\alpha_{xx} - \alpha_{yy}, \alpha_{xy})$
Φ	+2	$2 \cos 3\phi$	$2 \cos 2.3\phi$	$2 \cos 3.3\phi$	...	0		
...		

C_{2h}	E	$C_2(z)$	$\sigma_h(xy)$	i		
A_g	+1	+1	+1	+1	R_z	$\alpha_{xx}, \alpha_{yy}, \alpha_{zz}, \alpha_{xy}$
A_u	+1	+1	-1	-1	T_z	
B_g	+1	-1	-1	+1	R_x, R_y	α_{yz}, α_{xz}
B_u	+1	-1	+1	-1	T_x, T_y	

D_3	E	$2C_3(z)$	$3C_2$		
A_1	+1	+1	+1		$\alpha_{xx} + \alpha_{yy}, \alpha_{zz}$
A_2	+1	+1	-1	T_z, R_z	
E	+2	-1	0	$(T_x, T_y), (R_x, R_y)$	$(\alpha_{xx} - \alpha_{yy}, \alpha_{xy}), (\alpha_{yz}, \alpha_{xz})$

$D_{2d} \equiv V_d$	E	$2S_4(z)$	$S_4^2 \equiv C_2$	$2C_2$	$2\sigma_d$		
A_1	+1	+1	+1	+1	+1		$\alpha_{xx} + \alpha_{yy}, \alpha_{zz}$
A_2	+1	+1	+1	-1	-1	R_z	
B_1	+1	-1	+1	+1	-1		$\alpha_{xx} - \alpha_{yy}$
B_2	+1	-1	+1	-1	+1	T_z	α_{xy}
E	+2	0	-2	0	0	$(T_x, T_y), (R_x, R_y)$	$(\alpha_{yz}, \alpha_{xz})$

D_{3d}	E	$2S_6(z)$	$2S_6^2 \equiv 2C_3$	$S_6^3 \equiv S_2 \equiv i$	$3C_2$	$3\sigma_d$		
A_{1g}	+1	+1	+1	+1	+1	+1		$\alpha_{xx} + \alpha_{yy}, \alpha_{zz}$
A_{1u}	+1	-1	+1	-1	+1	-1		
A_{2g}	+1	+1	+1	+1	-1	-1	R_z	
A_{2u}	+1	-1	+1	-1	-1	+1	T_z	
E_g	+2	-1	-1	+2	0	0	(R_x, R_y)	$(\alpha_{xx} - \alpha_{yy}, \alpha_{xy}), (\alpha_{yz}, \alpha_{xz})$
E_u	+2	+1	-1	-2	0	0	(T_x, T_y)	

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D_{4d}	E	$2S_8(z)$	$2S_8^2 = 2C_4$	$2S_8^3$	$S_8^4 = C_2''$	$4C_2$	$4\sigma_d$		
A_1	+1	+1	+1	+1	+1	+1	+1	R_z	$\alpha_{xx} + \alpha_{yy}, \alpha_{zz}$
A_2	+1	+1	+1	+1	+1	-1	-1		
B_1	+1	-1	+1	-1	+1	+1	-1		
B_2	+1	-1	+1	-1	+1	-1	+1		
E_1	+2	$+\sqrt{2}$	0	$-\sqrt{2}$	-2	0	0	(T_x, T_y)	$(\alpha_{xx} - \alpha_{yy}, \alpha_{xy})$
E_2	+2	0	-2	0	+2	0	0		
E_3	+2	$-\sqrt{2}$	0	$+\sqrt{2}$	-2	0	0	(R_x, R_y)	$(\alpha_{yz}, \alpha_{xz})$

$D_{2h} = V_h$	E	$\sigma(xy)$	$\sigma(xz)$	$\sigma(yz)$	i	$C_2(z)$	$C_2(y)$	$C_2(x)$		
A_g	+1	+1	+1	+1	+1	+1	+1	+1	R_z T_z R_y T_y R_x T_x	$\alpha_{xx}, \alpha_{yy}, \alpha_{zz}$ α_{xy} α_{xz} α_{yz}
A_u	+1	-1	-1	-1	-1	+1	+1	+1		
B_{1g}	+1	+1	-1	-1	+1	+1	-1	-1		
B_{1u}	+1	-1	+1	+1	-1	+1	-1	-1		
B_{2g}	+1	-1	+1	-1	+1	-1	+1	-1		
B_{2u}	+1	+1	-1	+1	-1	-1	+1	-1		
B_{3g}	+1	-1	-1	+1	+1	-1	-1	+1		
B_{3u}	+1	+1	+1	-1	-1	-1	-1	+1		

D_{3h}	E	$2C_3(z)$	$3C_2$	σ_h	$2S_3$	$3\sigma_v$		
A'_1	+1	+1	+1	+1	+1	+1	R_z T_z (T_x, T_y) (R_x, R_y)	$\alpha_{xx} + \alpha_{yy}, \alpha_{zz}$ $(\alpha_{xx} - \alpha_{yy}, \alpha_{xy})$ $(\alpha_{yz}, \alpha_{xz})$
A''_1	+1	+1	+1	-1	-1	-1		
A'_2	+1	+1	-1	+1	+1	-1		
A''_2	+1	+1	-1	-1	-1	+1		
E'	+2	-1	0	+2	-1	0		
E''	+2	-1	0	-2	+1	0		

D_{4h}	E	$2C_4(z)$	$C_4^2 = C_2''$	$2C_2$	$2C_2'$	σ_h	$2\sigma_v$	$2\sigma_d$	$2S_4$	$S_2 = i$		
A_{1g}	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	R_z T_z (R_x, R_y) (T_x, T_y)	$\alpha_{xx} + \alpha_{yy}, \alpha_{zz}$ $(\alpha_{yz}, \alpha_{xz})$
A_{1u}	+1	+1	+1	+1	+1	-1	-1	-1	-1	-1		
A_{2g}	+1	+1	+1	-1	-1	+1	-1	-1	+1	+1		
A_{2u}	+1	+1	+1	-1	-1	-1	+1	+1	-1	-1		
B_{1g}	+1	-1	+1	+1	-1	+1	+1	-1	-1	+1		
B_{1u}	+1	-1	+1	+1	-1	-1	-1	+1	+1	-1		
B_{2g}	+1	-1	+1	-1	+1	+1	-1	+1	-1	+1		
B_{2u}	+1	-1	+1	-1	+1	-1	+1	-1	+1	-1		
E_g	+2	0	-2	0	0	-2	0	0	0	+2		
E_u	+2	0	-2	0	0	+2	0	0	0	-2		

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D_{5h}	E	$2C_5(z)$	$2C_5^2$	σ_h	$5C_2$	$5\sigma_v$	$2S_5$	$2S_5^3$		
A_1'	+1	+1	+1	+1	+1	+1	+1	+1	R_z T_z (T_x, T_y) (R_x, R_y)	$\alpha_{xx} + \alpha_{yy}, \alpha_{zz}$ $(\alpha_{yz}, \alpha_{xz})$ $(\alpha_{xx} - \alpha_{yy}, \alpha_{xy})$
A_1''	+1	+1	+1	-1	+1	-1	-1	-1		
A_2'	+1	+1	+1	+1	-1	-1	+1	+1		
A_2''	+1	+1	+1	-1	-1	+1	-1	-1		
E_1'	+2	$2 \cos 72^\circ$	$2 \cos 144^\circ$	+2	0	0	$+2 \cos 72^\circ$	$+2 \cos 144^\circ$		
E_1''	+2	$2 \cos 72^\circ$	$2 \cos 144^\circ$	-2	0	0	$-2 \cos 72^\circ$	$-2 \cos 144^\circ$		
E_2'	+2	$2 \cos 144^\circ$	$2 \cos 72^\circ$	+2	0	0	$+2 \cos 144^\circ$	$+2 \cos 72^\circ$		
E_2''	+2	$2 \cos 144^\circ$	$2 \cos 72^\circ$	-2	0	0	$-2 \cos 144^\circ$	$-2 \cos 72^\circ$		

D_{6h}	E	$2C_6(z)$	$2C_6^2 \equiv 2C_3$	$C_6^3 \equiv C_2$	$3C_2$	$3C_2'$	σ_h	$3\sigma_v$	$3\sigma_d$	$2S_6$	$2S_3$	$S_6^3 \equiv S_2 \equiv i$		
A_{1g}	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	R_z T_z (R_x, R_y) (T_x, T_y)	$\alpha_{xx} + \alpha_{yy}, \alpha_{zz}$ $(\alpha_{yz}, \alpha_{xz})$ $(\alpha_{xx} - \alpha_{yy}, \alpha_{xy})$
A_{1u}	+1	+1	+1	+1	+1	+1	-1	-1	-1	-1	-1	-1		
A_{2g}	+1	+1	+1	+1	-1	-1	+1	-1	-1	+1	+1	+1		
A_{2u}	+1	+1	+1	+1	-1	-1	-1	+1	+1	-1	-1	-1		
B_{1g}	+1	-1	+1	-1	+1	-1	-1	-1	+1	+1	-1	+1		
B_{1u}	+1	-1	+1	-1	+1	-1	+1	+1	-1	-1	+1	-1		
B_{2g}	+1	-1	+1	-1	-1	+1	-1	+1	-1	+1	-1	+1		
B_{2u}	+1	-1	+1	-1	-1	+1	+1	-1	+1	-1	+1	-1		
E_{1g}	+2	+1	-1	-2	0	0	-2	0	0	-1	+1	+2		
E_{1u}	+2	+1	-1	-2	0	0	+2	0	0	+1	-1	-2		
E_{2g}	+2	-1	-1	+2	0	0	+2	0	0	-1	-1	+2		
E_{2u}	+2	-1	-1	+2	0	0	-2	0	0	+1	+1	-2		

$D_{\infty h}$	E	$2C_\infty^\phi$	$2C_\infty^{2\phi}$	$2C_\infty^{3\phi}$...	σ_h	∞C_2	$\infty \sigma_v$	$2S_\infty^\phi$	$2S_\infty^{2\phi}$...	$S_2 \equiv i$		
\hat{O}_g^+	+1	+1	+1	+1	...	+1	+1	+1	+1	+1	...	+1	T_z R_z	$\alpha_{xx} + \alpha_{yy}, \alpha_{zz}$
\hat{O}_u^+	+1	+1	+1	+1	...	-1	-1	+1	-1	-1	...	-1		
\hat{O}_g^-	+1	+1	+1	+1	...	+1	-1	-1	+1	+1	...	+1		
\hat{O}_u^-	+1	+1	+1	+1	...	-1	+1	-1	-1	-1	...	-1		
Π_g	+2	$2 \cos \phi$	$2 \cos 2\phi$	$2 \cos 3\phi$...	-2	0	0	$-2 \cos \phi$	$-2 \cos 2\phi$...	+2	(R_x, R_y) (T_x, T_y)	$(\alpha_{yz}, \alpha_{xz})$
Π_u	+2	$2 \cos \phi$	$2 \cos 2\phi$	$2 \cos 3\phi$	...	+2	0	0	$+2 \cos \phi$	$+2 \cos 2\phi$	...	-2
Δ_g	+2	$2 \cos 2\phi$	$2 \cos 4\phi$	$2 \cos 6\phi$...	+2	0	0	$+2 \cos 2\phi$	$+2 \cos 4\phi$...	+2	$(\alpha_{xx} - \alpha_{yy}, \alpha_{xy})$	
Δ_u	+2	$2 \cos 2\phi$	$2 \cos 4\phi$	$2 \cos 6\phi$...	-2	0	0	$-2 \cos 2\phi$	$-2 \cos 4\phi$...	-2		
Φ_g	+2	$2 \cos 3\phi$	$2 \cos 6\phi$	$2 \cos 9\phi$...	-2	0	0	$-2 \cos 3\phi$	$-2 \cos 4\phi$...	+2		
Φ_u	+2	$2 \cos 3\phi$	$2 \cos 6\phi$	$2 \cos 9\phi$...	+2	0	0	$+2 \cos 3\phi$	$+2 \cos 4\phi$...	-2		
...		

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T_d	E	$8C_3$	$6\sigma_d$	$6S_4$	$3S_4^2 \equiv 3C_2$		
A_1	+1	+1	+1	+1	+1		$\alpha_{xx} + \alpha_{yy} + \alpha_{zz}$
A_2	+1	+1	-1	-1	+1		
E	+2	-1	0	0	+2		$(\alpha_{xx} + \alpha_{yy} - 2\alpha_{zz}, \alpha_{xx} - \alpha_{yy})$
F_1	+3	0	-1	+1	-1	(R_x, R_y, R_z)	
F_2	+3	0	+1	-1	-1	(T_x, T_y, T_z)	$(\alpha_{xy}, \alpha_{yz}, \alpha_{xz})$

O_h	E	$8C_3$	$6C_2$	$6C_4$	$3C_4^2 \equiv 3C_2''$	$S_2 \equiv i$	$6S_4$	$8S_6$	$3\sigma_h$	$6\sigma_d$		
A_{1g}	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1		$\alpha_{xx} + \alpha_{yy} + \alpha_{zz}$
A_{1u}	+1	+1	+1	+1	+1	-1	-1	-1	-1	-1		
A_{2g}	+1	+1	-1	-1	+1	+1	-1	+1	+1	-1		
A_{2u}	+1	+1	-1	-1	+1	-1	+1	-1	-1	+1		
E_g	+2	-1	0	0	+2	+2	0	-1	+2	0		$(\alpha_{xx} + \alpha_{yy} - 2\alpha_{zz}, \alpha_{xx} - \alpha_{yy})$
E_u	+2	-1	0	0	+2	-2	0	+1	-2	0		
F_{1g}	+3	0	-1	+1	-1	+3	+1	0	-1	-1	(R_x, R_y, R_z)	
F_{1u}	+3	0	-1	+1	-1	-3	-1	0	+1	+1	(T_x, T_y, T_z)	
F_{2g}	+3	0	+1	-1	-1	+3	-1	0	-1	+1		$(\alpha_{xy}, \alpha_{yz}, \alpha_{xz})$
F_{2u}	+3	0	+1	-1	-1	-3	+1	0	+1	-1		