Supplementary Material

The inequality constraints and one equality constraint are listed in Equation (S-1), where the units are expressed in 'GPa'. The numerical coefficients presented in Equation (S-1) are derived from the property closure of IN-718 alloy following the four-step procedure described in section II. Additionally, the surfaces corresponding to all inequality constraints are illustrated in cyan color in Fig. 1.

$$\left.\begin{aligned}
0.27685C_{11} + 0.27685C_{22} + 0.92017C_{12} &\leq 270.44284 \\
-0.15576C_{11} - 0.15066C_{22} + 0.97624C_{12} &\leq 47.22389 \\
-0.63256C_{11} - 0.05766C_{22} - 0.77236C_{12} &\leq -278.51010 \\
-0.64474C_{11} + 0.40416C_{22} - 0.64882C_{12} &\leq -134.13403 \\
0.32903C_{11} + 0.80507C_{22} - 0.49356C_{12} &\leq 285.55942 \\
-0.62874C_{11} + 0.45171C_{22} - 0.63297C_{12} &\leq -113.88138 \\
0.39886C_{11} + 0.51041C_{22} + 0.76184C_{12} &\leq 351.93696 \\
0.80507C_{11} + 0.32903C_{22} - 0.49356C_{12} &\leq 285.55942 \\
0.51041C_{11} + 0.39886C_{22} + 0.76184C_{12} &\leq 351.93696 \\
0.42855C_{11} + 0.42855C_{22} + 0.79541C_{12} &\leq 339.95893 \\
0.45171C_{11} - 0.62874C_{22} - 0.63297C_{12} &\leq -113.88138 \\
-0.05766C_{11} - 0.63256C_{22} - 0.77236C_{12} &\leq -278.51010 \\
-0.15066C_{11} - 0.15576C_{22} + 0.97624C_{12} &\leq 47.22389 \\
0.27685C_{11} + 0.27685C_{22} + 0.92017C_{12} &\leq 270.44284 \\
0.40416C_{11} - 0.64474C_{22} - 0.64882C_{12} &\leq -134.13403 \\
-0.15321C_{11} - 0.15321C_{22} + 0.97625C_{12} &\leq 47.22683 \\
C_{66} &= 1.0018C_{12} - 34.736
\end{aligned}\right\} \quad \text{(S-1)}$$