materials

**Supplementary materials**

This table shows the 24 features selected by relying on relevant literature and thermodynamic equation derivation. Some of the eigenvalues were obtained by searching the relevant literature and the rest of the eigenvalues were obtained by calculating the formulas in the table.

**Table S1.** Feature descriptor and its calculation formula.

| Feature | Symbol | Formula |
|---|---|---|
| Atomic number | Z | / |
| Period | / | / |
| Group | / | / |
| Electronegativity | EN | / |
| Atomic volume | V | $V=m/\rho$ |
| Melting point | m.p. | / |
| Correlated atomic mass | m | / |
| Atomic radius | Ra | / |
| Ionic radius | Ri | / |
| Covalent radius | Rc | / |
| Electron configuration s | s | / |
| Electron configuration p | p | / |
| Electron configuration d | d | / |
| Electron configuration f | f | / |
| Mole fraction of alloying elements | $X_A$ | $X_A= m_A/( m_A+ m_{Al}+ m_{SiC})$ |
| Logarithm of the mole fraction of alloying elements | $\ln X_A$ | $\ln X_A= \ln X_A$ |
| Mole fraction of the aluminum matrix | $X_{Al}$ | $X_{Al}= m_{Al}/( m_A+ m_{Al}+m_{SiC})$ |
| Logarithm of the mole fraction of the aluminum matrix | $\ln X_{Al}$ | $\ln X_{Al}=\ln X_{Al}$ |
| Entropy of mixing | $\Delta Smix$ | $\Delta Smix=-R(X_A\ln X_A+X_{Al}+\ln X_{Al})$ |
| Gibbs free energy of the alloying element | $G_A$ | $G_A=U-TS$ |
| Hemical potential | $\mu_A$ | $\mu_A=G_A+RT\ln X_A$ |
| First ionization energy | I1 | / |
| Second ionization energy | I2 | / |
| Third ionization energy | I3 | / |