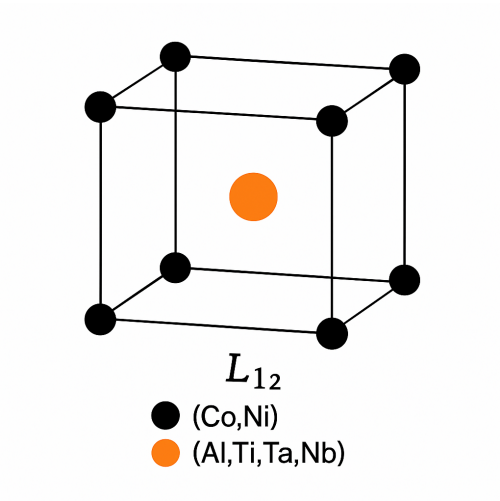
$L1_2$ Crystal Structure – Technical Explanation

According to Nabarro and de Villiers in "The Physics of Creep", the $L1_2$ structure is an ordered cubic derivative of the FCC lattice, typical of γ′ (gamma prime) precipitates in Ni- and Co-based superalloys. This phase is responsible for precipitation strengthening through coherent intermetallic compounds of the type $(Co,Ni)_3(Al,Ti,Ta,Nb)$.

Key characteristics:

- $L1_2$ is an ordered FCC structure derived from Cu_3Au.
- (Co,Ni) atoms occupy cube corners and face centers.
- (Al,Ti,Ta,Nb) atoms occupy the cube center.
- The γ′ phase remains coherent with the γ matrix, improving creep resistance and high-temperature strength.



The ordered nature of $L1_2$ causes significant strengthening because the γ′ precipitates resist dislocation movement through coherency strains and anti-phase boundary formation. This is fundamental in high-temperature applications such as gas turbines, reformers, petrochemical reactors, and other components requiring long-term creep resistance.