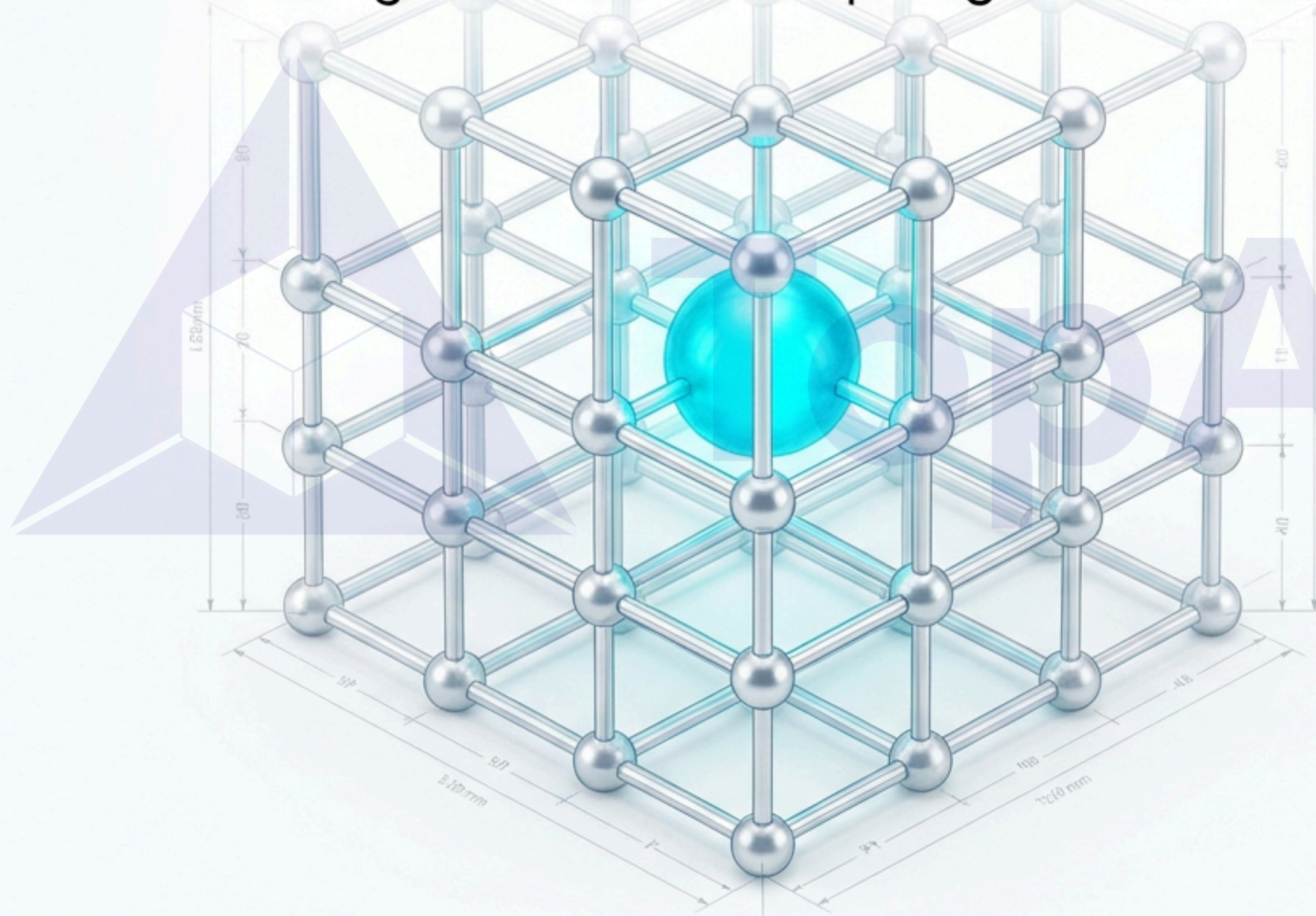


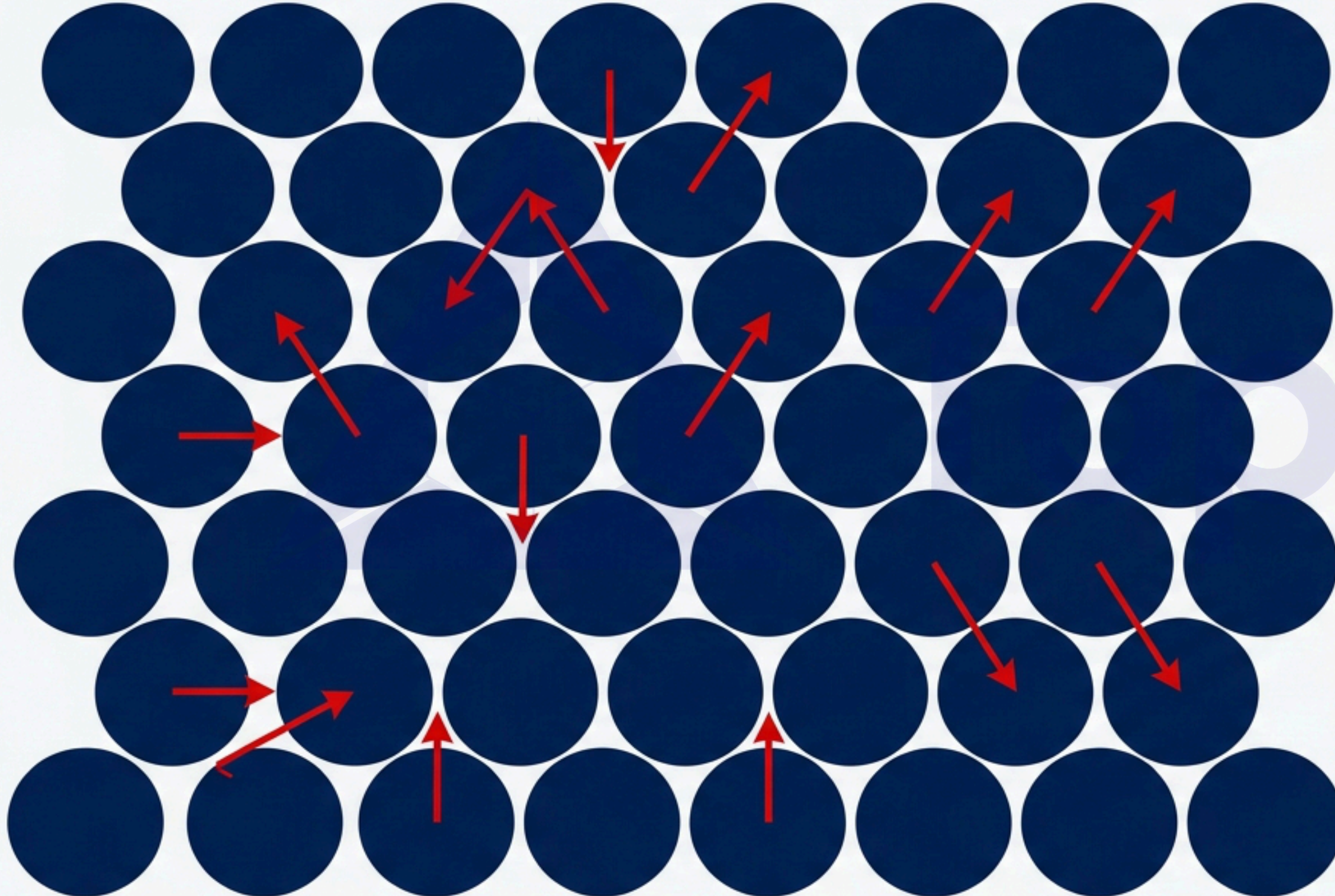
4.3.13 Formation of Interstitial Compounds



Mastering d-Block Elements | Inorganic Chemistry

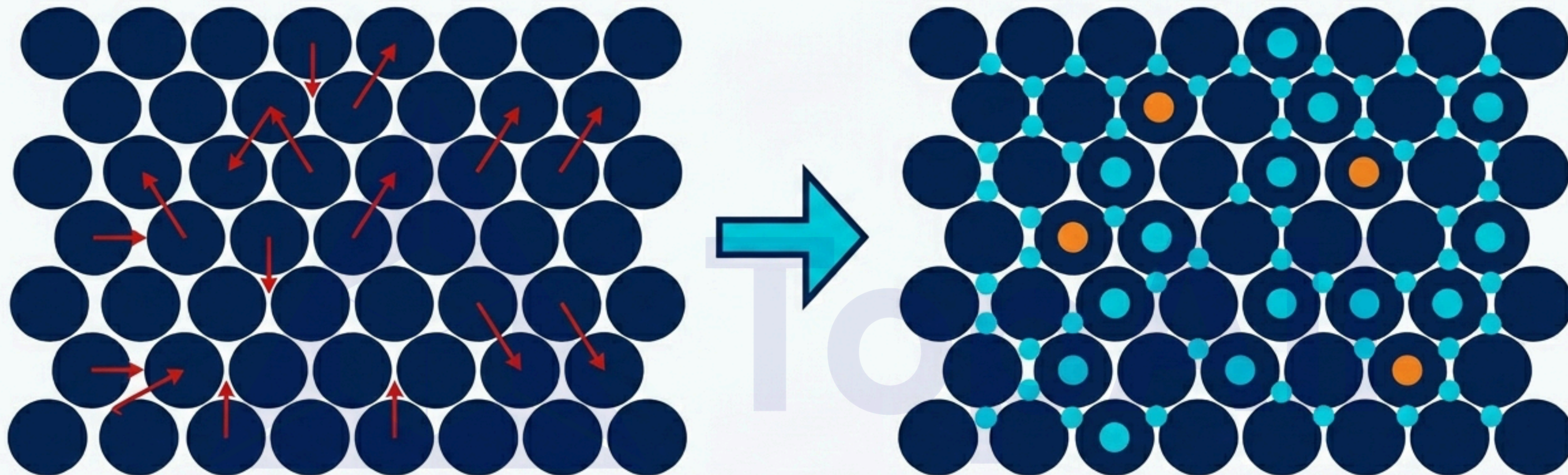


The Host Lattice: Finding the Gaps



Transition metals crystallize in **close-packed structures** (hcp, ccp, bcc). Despite tight packing, empty voids—interstitial spaces—always remain.

Trapping the Guest Atoms



The Guests

Small atoms like Hydrogen (H), Carbon (C), and Nitrogen (N).

The Mechanism

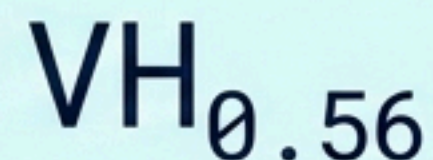
Trapped inside the crystal lattices of transition metals during formation.

The Nature

Neither typically ionic nor typically covalent.

The Rule-Breakers: Non-Stoichiometric Formulas

These compounds do not follow normal oxidation states or valency rules.



Notice the decimal? The composition depends entirely on the physical voids filled, not valency.



You've Learned the Theory. Let's Test Them Now.

$$E=mc^2$$



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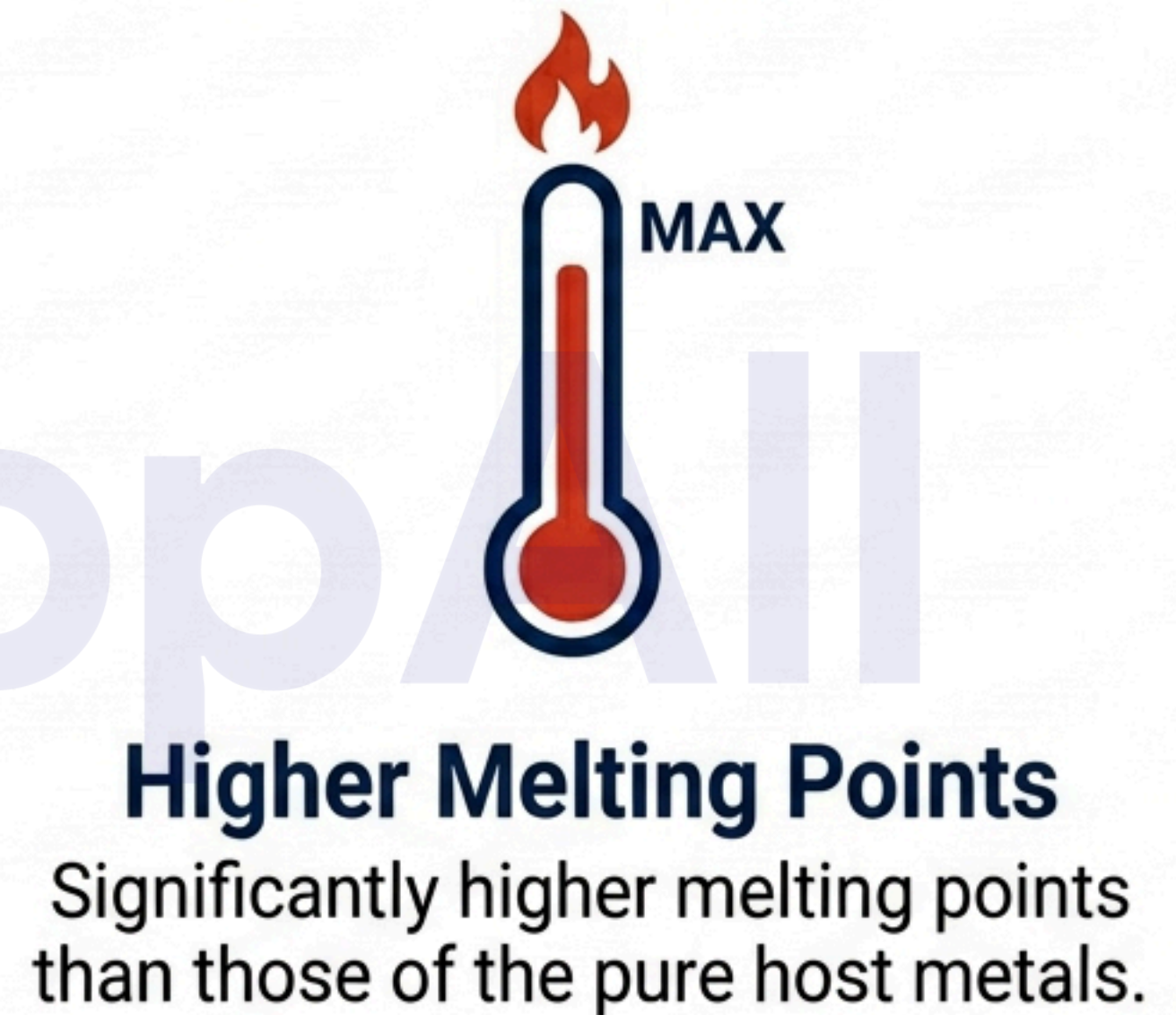
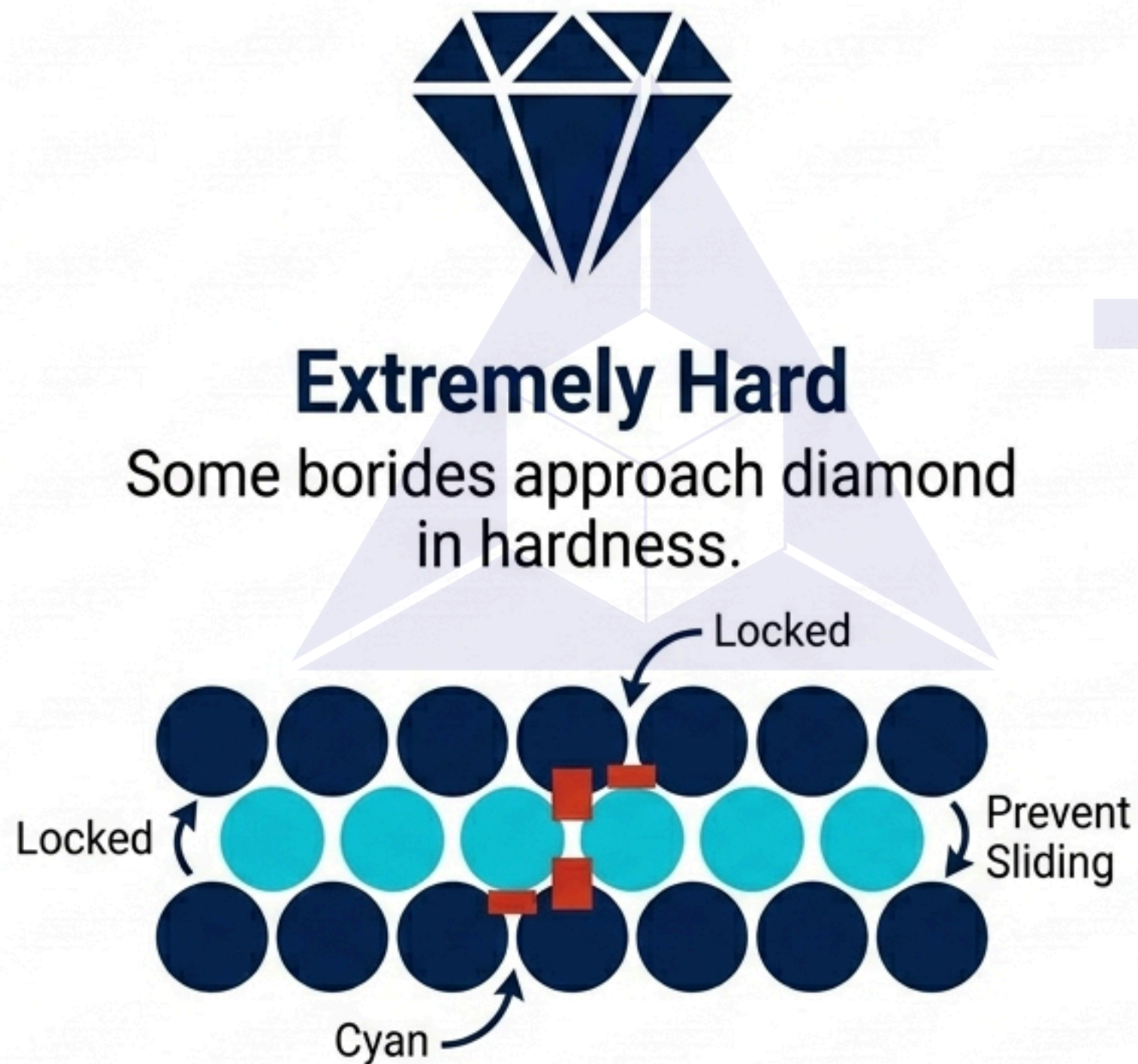
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Physical Alterations: Hardness & Heat



Electrical & Chemical Resilience



Retains Metallic Conductivity

The sea of mobile electrons remains unaffected by the small interstitial atoms.



Chemically Inert

The trapped atoms physically stabilize the metal lattice, rendering the compound highly unreactive.

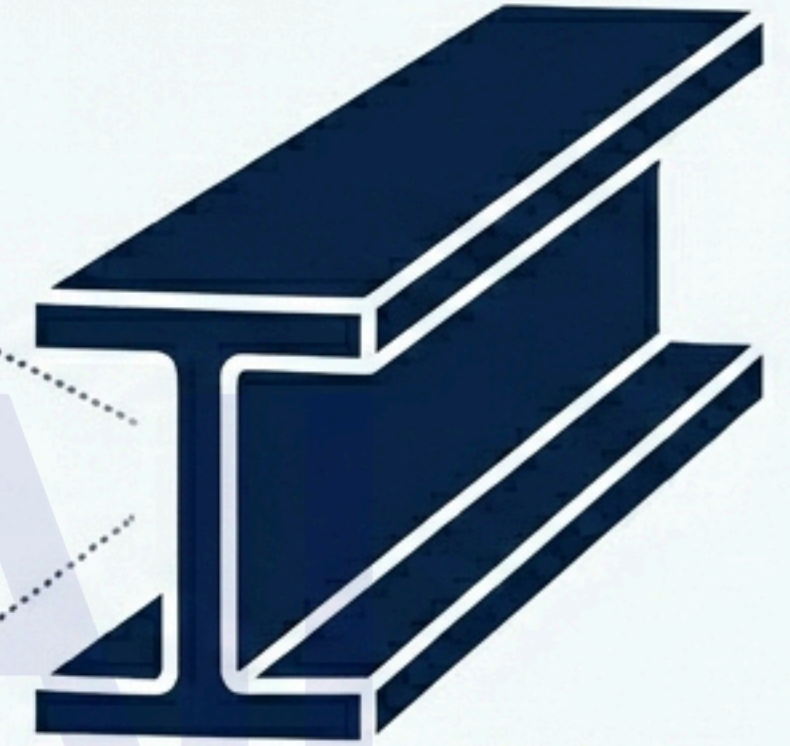
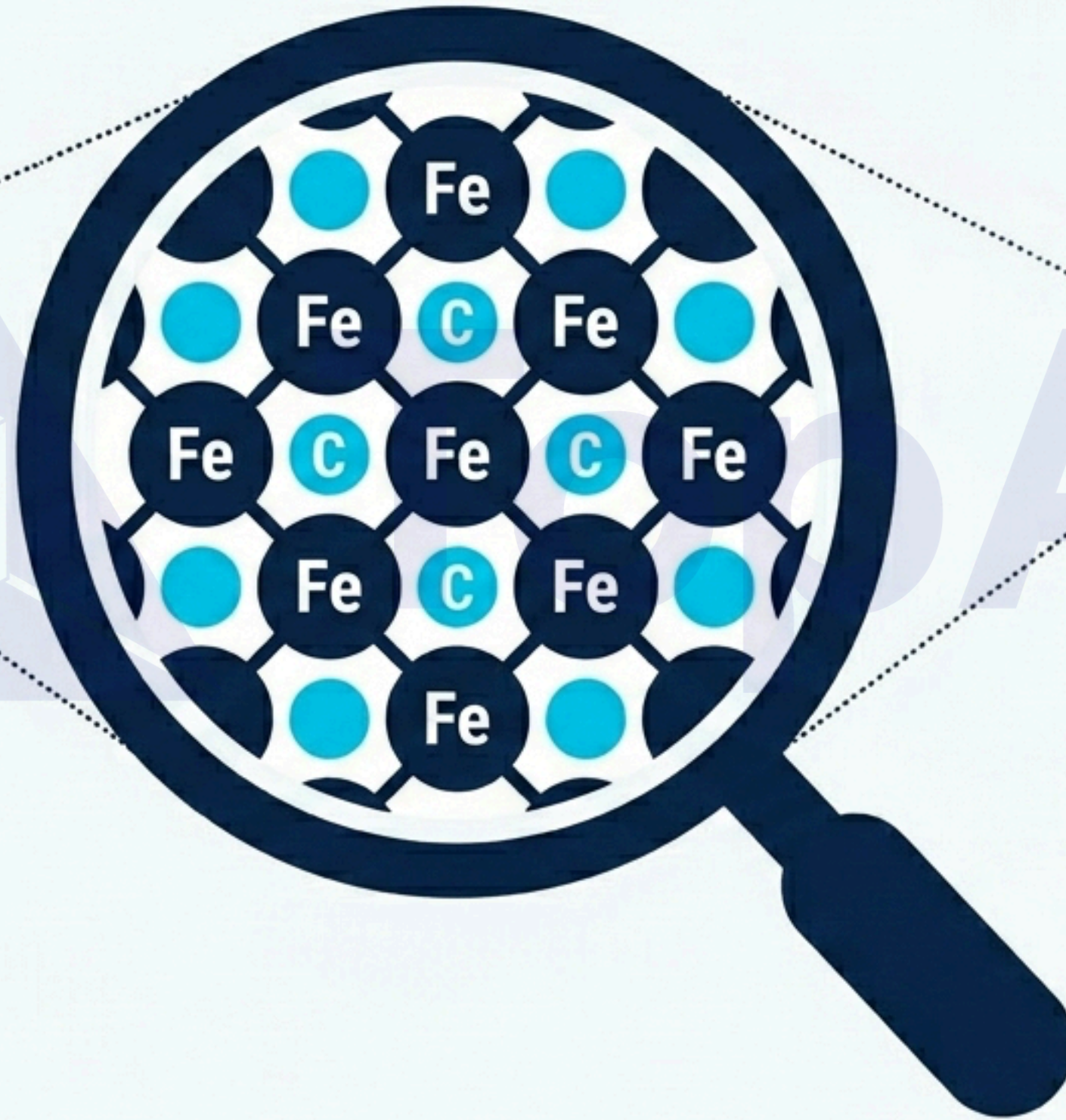
Pure Metal vs. Interstitial Compound

Property	Pure Metal	Interstitial Compound
Melting Point	High	Higher
Hardness	Hard	Extremely Hard (Diamond-like borides)
Chemical Reactivity	Reactive / Oxidizes	Chemically Inert
Conductivity	Good Conductor	Retains Conductivity

Real-World Applications



Tooling & Cutting:
Borides and Carbides are utilized in high-speed cutting tools due to immense hardness.



Alloy Formation:
Carbon trapped in Iron forms the basis of Steel, drastically increasing tensile strength.

Target NEET/JEE: High-Yield Traps



The Conductivity Trap

Examiners state that adding non-metals makes interstitial compounds insulators. FALSE. They retain metallic conductivity.

The Valency Trap

Formulas like $\text{VH}_{0.56}$ are not typos. They are non-stoichiometric. Do NOT try to balance them using standard oxidation states.

The Bonding Trap

These compounds are neither purely ionic nor purely covalent. They are a physical trapping phenomenon.

One-Minute Revision Map



Interstitial Compounds

Physical Alterations:
Higher Melting Point,
Extreme Hardness,
Retains Conductivity.

Composition: Metal Lattice
+ Small Atoms (H, C, N)

Examples: TiC, Fe₃H,
VH_{0.56}, TiH_{1.7}
(Non-stoichiometric)

Nature: Not ionic, not
covalent. Chemically
inert.



You've Learned the Theory.

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