

Direct Silicon to Carbon Bond Defined for TYPE-C Columns - HPLC Primer

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What Is a Direct Silicon–Carbon (Si–C) Bond on Cogent TYPE-C™ Columns—and Why It Matters?

Most traditional silica columns (Type A or Type B) attach organic ligands to the silica surface through an oxygen-bridged linkage (–Si–O–Si–C–) formed from organosilane reagents. That Si–O–Si–C architecture contains an Si–O bond that is comparatively susceptible to hydrolysis, which can shorten bonded-phase lifetime, shift selectivity, and alter retention, especially under aggressive pH or temperature.

In contrast, Cogent TYPE-C™ phases form a **direct silicon–carbon** (Si–C) bond to the surface during synthesis—eliminating the oxygen in the linkage—and producing an attachment that is far more resistant to hydrolytic cleavage. Breaking this Si–C bond requires “the proper catalyst and lots of energy,” and its durability is similar to a C–C bond in practical terms.

How TYPE-C™ Gets There: From Si–O–Si–C to Direct Si–C

- Traditional route (Type A/B silica): An organosilane (–Si–O–Si–C–) reacts with surface silanols to yield a siloxane bridge between the silica and the organic ligand. The presence of oxygen in this bridge is the weak link with respect to hydrolysis.
- TYPE-C™ route (silica-hydride surface): The chemistry used to build Cogent TYPE-C™ phases creates a direct Si–C bond to the surface—no oxygen in the linkage—resulting in a chemically tougher anchor for the bonded ligand.

Implication: The bonded phase on TYPE-C™ columns is less prone to bond cleavage and more stable across demanding methods, enabling consistent retention and longer service life.

Why the Si–C Bond Improves Real-World Methods

1. Hydrolytic Stability → Longer Lifetime

The Si–C linkage is highly resistant to hydrolysis, so TYPE-C™ bonded phases better tolerate water-rich conditions, temperature cycling, and broader pH exploration within silica limits—without the progressive loss of ligand that can change selectivity on conventional phases.

2. Retention & Selectivity Consistency

Because the attachment remains intact, selectivity drifts less over time. That’s especially valuable in regulated, validated methods and long sequences.

3. Method Flexibility (RP / ANP / NP)

The durable surface/ligand architecture supports TYPE-C™’s well-known versatility across

Reversed Phase, Aqueous Normal Phase (ANP), and Normal Phase modes, allowing orthogonal scouting on the same column platform. (The underlying reason: a robust anchor plus the unique silica-hydride surface chemistry.)

At-a-Glance: Attachment Chemistries

Attachment to Silica	Linkage	Hydrolysis Susceptibility	Practical Effect
Conventional Type A/B silica	Si-O-Si-C (siloxane bridge)	Higher (Si-O cleaves more readily)	Potential ligand loss → retention/selectivity shifts over time
Cogent TYPE-C™ silica hydride	Direct Si-C	Much lower (requires strong conditions to break)	Greater bonded-phase durability, consistent performance, longer life

Key Takeaways for Method Developers

- If you've observed gradual selectivity drift or loss of retention on conventional columns after harsh rinses, many injections, or exposure to challenging pH, a TYPE-C™ Si-C-bonded phase can help by minimizing hydrolysis-driven ligand loss.
- For long sequences, rugged LC-MS workflows, or multi-mode screening on one platform, Si-C durability helps preserve the chromatographic "personality" of the column across runs and days.



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