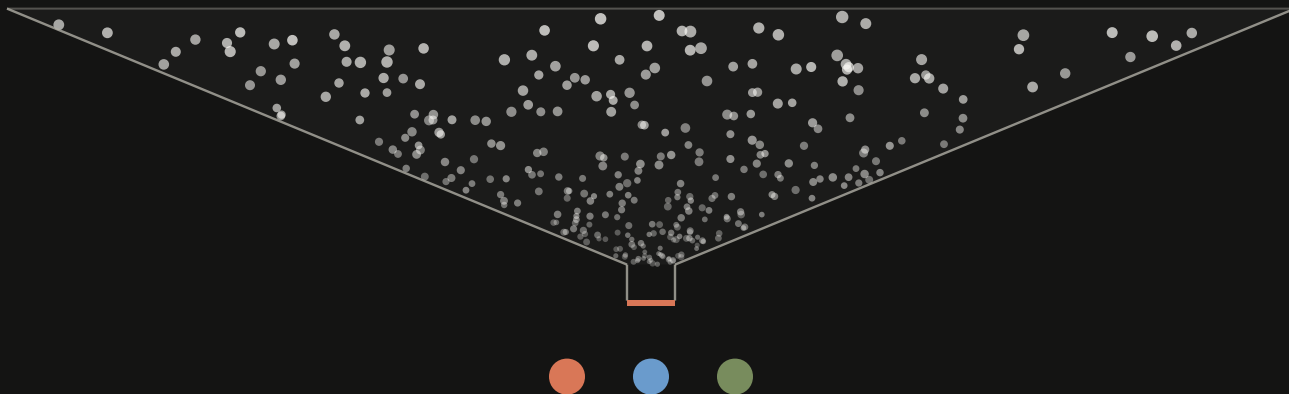


INFLECTION.

THE WEEKLY MAGAZINE OF INNOVATION

ISSUE 02 · FRIDAY, JULY 31, 2026 · DEEP DIVE — AI-DESIGNED MATERIALS



300,000,000,000,000 CANDIDATES

20 SURVIVORS

THE SUBTRACTION ENGINE

Three hundred trillion molecules. Twenty *survivors*.

A British startup raised \$450 million this week to run what it calls a search engine for matter. Read the fine print and the product isn't discovery at all — it's elimination, at a ratio of fifteen trillion to one. The scarcest thing in materials science was never ideas.

01 Why the most valuable new material will be the worse one

02 384,870 "stable" crystals — and scant evidence of a useful one

03 Eight tonnes of iridium stand between us and green hydrogen

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DISPATCH

Generation is the demo. Rejection is the product.

Every technology gets described by the thing it produces. Printing presses make books; refineries make fuel; generative models make... generations. It is an honest description and, occasionally, a completely misleading one.

This week CuspAI closed a \$450 million round at a \$2.6 billion valuation — roughly five times what it was worth nine months ago — for a platform it calls a search engine for the material world. But the number buried in the announcement is far better than the headline. Working with the Finnish chemicals firm Kemira, the company says it screened a space of 300 trillion candidate molecular structures and handed back twenty validated ones. Twenty. In six months.

Hold that ratio in your head — fifteen trillion to one — and the whole industry looks different. The model's job is not to imagine. Imagination is now free and effectively infinite. The model's job is to *refuse*: to burn through a combinatorial space at a cost-per-rejection low enough that the wet lab, which is still slow and still human, only ever meets the survivors. That is this issue's lens, and it turns out to explain most of the week's other headlines too.

It is a useful lens because it is portable. Ask it of any system that has recently gotten dramatically cheaper and it tells you where the value went. Ask it of the week's memory IPO, its gigawatt data-centre lease, its billion-dollar cancer-testing acquisition, and the same shape appears each time: somebody paid a great deal of money for the step that had just become the slowest one.

The Subtraction Engine

AI did not make materials discovery more creative. It made saying no almost free — and that, not invention, turns out to be the entire game.

BY THE EDITORS OF INFLECTION

Materials science runs on a famously brutal clock. It takes twenty years or more to carry a new material from a laboratory bench to a product on a shelf — the U.S. Materials Genome Initiative was launched in 2011 with the explicit, modest ambition of merely halving that. Lithium-ion chemistry was proposed in the mid-1970s and did not reach broad market adoption until the late 1990s. Nothing about that clock has ever been set by a shortage of ideas.

The bottleneck sits somewhere far less glamorous. A working material has to clear four gates in sequence. It must be thermodynamically plausible. It must be synthesizable by a route somebody can actually run. It must survive contact with a real operating environment. And it must be manufacturable from inputs that exist in industrial quantities at a tolerable price. Each gate discards most of what the previous gate passed, and the cost of the whole pipeline is dominated by a single quantity: how expensively you fail.

For most of the field's history, failure was expensive because the only trustworthy filter was the experiment itself. You made the thing, then you found out. Density-functional theory helped; high-throughput computation helped more. But the funnel stayed narrow at the top, because you could only afford to consider candidates you had already decided were worth considering. The search space was not explored so much as guessed at.

What changed is the price of a guess. Machine-learned interatomic potentials — Meta's open-source Universal Model for Atoms among them — approximate quantum-mechanical energies at a small fraction of the cost of solving them

outright. A candidate can now be considered and thrown away without a beaker, a furnace, or a graduate student's year.

The consequence is not that the field became more imaginative. It is that the field can finally afford to be ruthless.

There is a second, subtler effect. When rejection is cheap, you can define a search by the requirement rather than by the family of compounds you already happen to know. Traditional materials programmes begin with a chemistry — perovskites, metal-organic frameworks, high-entropy alloys — and ask what it can be persuaded to do. A property-first search inverts that. Inverting it is only affordable if failure is nearly free.

Which is why the interesting metric in this field is no longer accuracy. It is throughput per dollar of rejection. A model that is right ninety-nine times in a hundred but costs a week per evaluation is worth less than one that is right once in a thousand tries and evaluates a million candidates before lunch. Precision is a virtue when experiments are the filter. When the filter is arithmetic, recall at volume wins.

What \$450 million actually bought

A FUNNEL, NOT A FOUNTAIN

CuspAI's platform, MIRA, is described by the company as a search engine for the material world. A partner specifies the physical properties they need — conductivity, thermal tolerance, selectivity for a particular contaminant — and the system proposes compositions, designs synthesis routes matched to lab infrastructure that actually exists, and routes the work to a facility that can run it.

The Kemira engagement is the clearest published account of what that means in practice. The target was stripping PFAS compounds out of water. The search space was 300 trillion molecular structures. The output, six months later, was twenty validated candidates — work the company says previously took years.

“The model is not generating twenty molecules. It is destroying the other 299,999,999,999,980 — cheaply, and in the right order.”

THE BOTTLENECK MOVED. IT DIDN'T VANISH.

Note what is still slow. Twenty candidates in six months is not twenty candidates a week. Synthesis, characterisation and validation remain physical processes with physical clocks. And CuspAI's own design choice — generating routes explicitly matched to *available* lab infrastructure — is a quiet admission that the wet lab, not the GPU, sets the pace. The

platform's real cleverness is not that it finds good molecules. It is that it declines to propose molecules nobody can make.

WHO IS ACTUALLY BUYING

The customer list is the tell. ASML, Meta, Samsung and Hyundai are not research curiosities; they are companies with specific, expensive materials problems sitting squarely on a critical path. Nvidia is supplying compute to the newly launched AI Materials Foundry, a network of more than forty-five partners; Meta contributed the atomistic simulation layer beneath the platform.

The money followed the customers. The \$450 million round was led by Kleiner Perkins and NEA with Bezos Expeditions participating, valuing the four-year-old company at \$2.6 billion — up from \$520 million nine months earlier, on more than \$650 million raised in total.

And the field is crowded. Periodic Labs, founded by former OpenAI and Google DeepMind researchers, carries a \$1 billion valuation. Lila Sciences has raised over \$550 million. Paris-based Altrove is designing rare-earth-free alternatives outright — a detail worth remembering two pages from now.

What none of them advertise is the cost of being wrong. A candidate that survives the screen and fails in the lab consumes months of a partner's bench time, and the loop only compounds if those failures are rarer than the alternative. That is the number to ask for, and the one least often quoted.

THE FIELD, BY VALUATION

\$2.6B

CUSPAI • CAMBRIDGE, UK

Property-first search with paying customers — ASML, Meta, Samsung, Hyundai. Founded 2024.

\$1.0B

PERIODIC LABS • USA

Founded by former OpenAI and Google DeepMind researchers; autonomous experimentation focus.

\$550M+

LILA SCIENCES • FLAGSHIP

Raised, not valued. Scientific superintelligence framing across materials and life sciences.

From search space to supply chain

The commercial question is not whether a model can propose a better material. It is whether the proposal arrives in a form an industrial buyer can act on. Three things must be true at once: the candidate has to be real, the route to making it has to be runnable in a plant that already exists, and the inputs have to be procurable. Miss any one and you have produced a very expensive paper.

This is why the market is being repriced ahead of itself. AI-driven materials discovery was worth roughly \$0.74 billion in 2025 and is forecast to reach \$2.77 billion by 2030 — a 30% compound growth rate that is respectable, and nowhere

near enough to justify the capital now flowing in. Investors are not buying the market as measured. They are buying an option on what happens when the materials constraint stops binding in semiconductors, energy storage and water treatment.

The near-term payoff will likely look mundane rather than miraculous: a marginally cheaper catalyst, a coating that survives one more thermal cycle, a membrane that removes a step from a purification line. Unglamorous — and precisely the kind of change that moves a P&L.

FIELD NOTES · HOW A MATERIALS SEARCH ENGINE ACTUALLY RUNS

- 1 Specify.** The customer states properties, not chemistry — dielectric constant, operating temperature, binding affinity for a named contaminant. The search is defined by the requirement, never by a hunch about the compound.
- 2 Screen.** A generative model proposes candidate structures; machine-learned interatomic potentials score them at a fraction of the cost of full quantum simulation. Millions to trillions of options die here, in silico, before anyone touches glassware.
- 3 Synthesise.** Survivors are paired with a synthesis route constrained to equipment that exists, then routed to a partner lab. Results feed back and re-rank the model. This loop — not the model — is the product.

GLOSSARY

INTERATOMIC POTENTIAL

A learned function predicting a structure's energy and forces from atomic positions. The cheap stand-in for solving quantum mechanics.

CONVEX HULL

The stability frontier. A compound below the hull is thermodynamically favoured; above it, it tends to decompose into something else.

SYNTHESISABILITY

Whether a plausible structure has a route to being made at all. Predicted stability implies nothing about it.

PGM

Platinum-group metals — platinum, iridium, ruthenium and kin. Superb catalysts; geologically scarce and geographically concentrated.

THE PRACTICAL READ

For a buyer, the diligence question has changed shape. It is no longer “is your model accurate?” — every vendor will say yes, and produce a benchmark to prove it. Ask three questions instead. What is your cost per rejected candidate? How many physical experiments did your partners run last quarter? And which of your validated compounds is currently sitting inside somebody's production process?

The first question measures the engine. The second measures the loop. Only the third measures a business. Vendors in this category will answer the first happily, hedge on the second, and change the subject on the third — and the shape of those three answers will tell you more about how far along the field really is than any published benchmark.

The best new material of the decade will be the *worse* one

The move that looks like an error until you price the alternative.

The prestige framing of AI-for-materials is discovery: the room-temperature superconductor, the miracle cathode, the thing physics has not yet seen. Price that expectation into your strategy and you will be disappointed on schedule.

The valuable output is substitution. And substitution is almost always a downgrade.

Consider iridium. World production runs at roughly eight tonnes a year, recovered as a by-product of platinum mining. It is the standard anode catalyst in PEM electrolyzers, and at realistic loadings that entire global supply underwrites something on the order of 30 GW of electrolysis capacity. Green hydrogen at climate-relevant scale needs multiples of that. No amount of demand conjures more iridium; it is a geological fact with a mine schedule attached.

Now suppose a model proposes a catalyst fifteen percent less active than iridium oxide that contains no iridium at all. On every benchmark a materials scientist would publish, it is worse. On the only benchmark that decides whether hydrogen scales, it is infinitely better — because the incum-

bent's performance is simply unpurchasable above a hard ceiling.

That is the trade the capital is actually buying. Read the roster again: Altrove designing rare-earth-free alternatives; CuspAI on chip materials and PFAS removal; ASML, Samsung and Hyundai as customers. These are not moonshots. They are firms trying to delete specific elements from specific supply chains before those elements become the binding constraint on the business.

The product is not a better periodic table. It is a *shorter* one — a world in which fewer of your inputs are hostage to a single mine, a single country, or a single price shock. Which yields an uncomfortable instruction: stop asking your materials team what new properties they can reach. Ask which element on your bill of materials would hurt most if it doubled, and what an acceptable loss would be to design it out.

Framed that way, the twenty molecules Kemira received are not a scientific result. They are an insurance policy with a chemical formula.

WHY THE CONSENSUS DISAGREES

The sceptics have the better track record so far, and deserve to be taken seriously. In 2023 Google DeepMind announced 2.2 million AI-discovered crystals, 384,870 of them labelled stable, and framed it as nearly 800 years of knowledge. In 2024 the chemists Anthony Cheetham and Ram Seshadri examined the set and reported “scant evidence for compounds that fulfil the trifecta of novelty, credibility and utility” — many, they argued, were modest variations on known materials. The companion autonomous-synthesis result was contested on similar grounds.

Three limits remain unresolved. Predicted stability is not synthesisability, and synthesisability is not manufacturability: a

compound can be real, makeable by the gram, and still impossible to qualify into a semiconductor process — a multi-year exercise on its own. Most of these systems are trained on crystalline inorganics, while much industrial value sits in polymers, glasses, composites and interfaces, where data is thin and physics messy. And validation is still the rate limiter. Twenty candidates in six months is a real acceleration, but it is a laboratory number, not a supply-chain one. The honest position: this is a bet on a loop, not on a model — and the loop's slowest step is still a human in a lab.

Memory, medicine, megawatts

Each is a story about a queue forming somewhere new.

212×

SEMICONDUCTORS

ChangXin Memory Technologies priced an \$8.6 billion Shanghai listing this week — China's largest DRAM maker, oversubscribed 212 times by institutions, with more than 9.4 million retail accounts applying and the online tranche covered nearly 244 times. Trading opens July 27 at a market capitalisation near \$85 billion, placing CXMT in the same valuation tier as SK Hynix and Micron despite materially smaller revenue and older process technology. Demand landed below the frenzy some expected, damped by a broad Chinese semiconductor selloff. The signal stands regardless: memory, not logic, is where Beijing's self-sufficiency campaign is now placing its largest public bet.

SOURCE · REUTERS; SOUTH CHINA MORNING POST

1 GW

ENERGY

Hut 8 signed a second fifteen-year lease worth \$9.8 billion with an investment-grade tenant, fully contracting its planned one-gigawatt Beacon Point campus in Texas. The company was a bitcoin miner. What it actually owned — land, grid interconnection, power contracts, cooling, and the expertise to build all of it — turned out to be the genuinely scarce asset in the AI buildout. A single campus now approaches the electrical draw of a heavy industrial plant, which is a planning problem for utilities long before it is a compute problem for anyone else.

SOURCE · REUTERS

\$1.5B

MEDICINE

Tempus AI agreed to acquire Personalis for approximately \$1.5 billion, pairing a large clinical-and-molecular data platform with genomic tests that track circulating tumour DNA to detect recurrence and match therapies. In the same week Bristol Myers Squibb became the first life-sciences company to buy an Nvidia DGX SuperPOD built on the Vera Rubin architecture, saying AI tools already cut time-to-clinical-material by 20–30%. Both moves point the same way: in oncology the durable asset is validated data, not the model sitting on top of it.

SOURCE · TEMPUS AI; BRISTOL MYERS SQUIBB

The common thread: in all three cases the money went to the constraint, not to the capability. Nobody paid a premium this week for a better model. They paid for DRAM capacity, for grid interconnects, and for validated tumour data — the three things that could not be conjured by writing more software.

Seven figures that framed the week

300T

Candidate molecular structures CuspAI says it screened for Kemira — in six months.

20

Validated candidates that came out the other end. The funnel ratio: fifteen trillion to one.

\$2.6B

CuspAI's new valuation — roughly five times the \$520 million it carried nine months ago.

384,870

Crystals DeepMind's GNoME labelled stable in 2023; chemists later found “scant evidence” of novelty, credibility and utility.

8 t

Annual world iridium production — enough, at realistic loadings, for roughly 30 GW of PEM electrolysis. Total.

20 yrs

Traditional time to carry a material from discovery to market. Halving it was a national initiative.

\$9.8B

Hut 8's second fifteen-year lease, fully contracting a one-gigawatt Texas AI campus.

Where the queue forms next

There is a pattern here worth naming, because it recurs with almost embarrassing regularity. When a technology makes one step in a process dramatically cheaper, the value does not stay in that step. It migrates to whatever the newly cheap step now overwhelms.

Cheap compute made candidate generation free, and the value moved downstream to filtering. Cheap filtering is now making the wet lab the constraint, and so the value will move again — to synthesis throughput, to autonomous labs and robotic characterisation and the deeply unglamorous business of running more experiments per week. If you want to know where the next \$450 million goes, that is the address.

The week's other headlines rhyme. Memory became the semiconductor bottleneck, so China priced an \$8.6 billion IPO around it. Electricity became the AI bottleneck, so a

former bitcoin miner signed a \$9.8 billion lease on land and grid interconnects. Validated clinical data became the oncology bottleneck, so Tempus paid \$1.5 billion for a testing company rather than for a model.

None of these are stories about better algorithms. They are stories about where the queue formed next — and each began with something becoming so cheap that its neighbour became the wall.

Which suggests the question to carry forward. Not “what can this system now do?” That question gets answered generously, repeatedly, and usually by the people selling it. The better question is the one that finds the wall before the market does.

On the evidence of this week, the wall is made of glassware.

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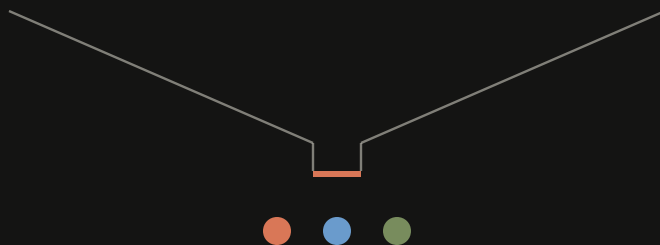
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NEXT ISSUE · FRIDAY

THE LENS

*What did this week make so cheap
that something else became
the **wall**?*

COLOPHON

Researched, written & designed with Claude. Typeset in Poppins & Lora on the Anthropic palette.
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