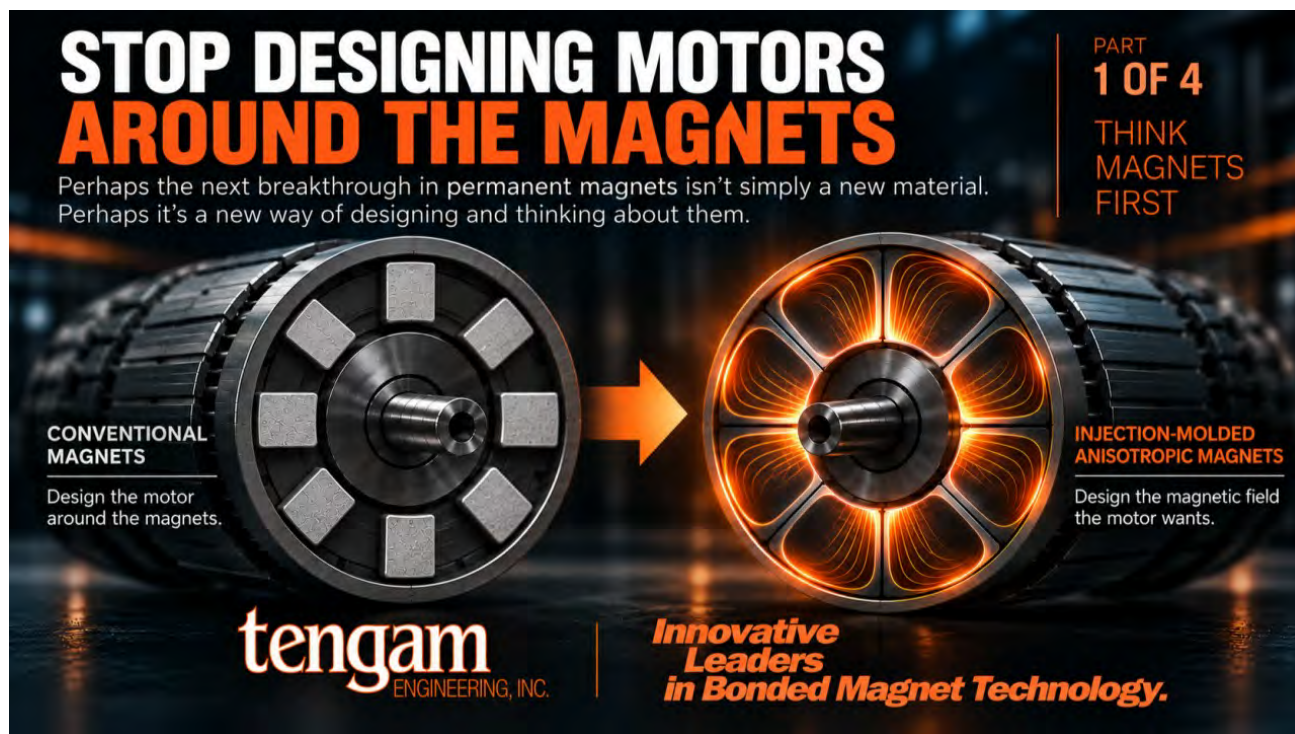


Think Magnets First

Tengam Engineering Inc | September 8, 2026



Conceptual illustration only. Motor design with conventional magnet versus magnetic geometry with anisotropic orientation around the desired field.

In this part 1 of 4 series of posts, I propose an important “new way” of thinking about magnets and their importance in motors. Perhaps the next breakthrough in permanent magnets isn’t simply a new material. Perhaps it’s a new way of designing and thinking about magnets, and their use within the motor topology. Design the field you want. Then manufacture the magnetic system to create it.

For more than 40 years, sintered NdFeB has been the benchmark for high-performance permanent magnets. Its development transformed electric motors, electronics, automation and countless other technologies. Tengam started molding NdFeB magnets in 1986 and watched as the material affected the evolution of these technologies. Yet as the industry searches for the “next” permanent magnet, we continue to ask essentially the same question:

What material can we manufacture that will compete with NdFeB?

At Tengam Engineering, we think there is another question worth asking:

What if we design the magnetic field the motor wants rather than continuing to design motors around the magnets?

That may sound like a subtle distinction. It isn't.

Conventional sintered permanent magnets impose significant manufacturing constraints. Magnets must be pressed, sintered, machined or ground into manufacturable geometries. They then have to be magnetized, handled, inserted, bonded or mechanically retained within an assembly. As a result, electromagnetic designers frequently begin with a limited menu of practical magnet shapes and orientations - rectangles, arcs, bread-loaf geometries and segmented rings - and design the motor around those limitations.

When the desired magnetic field becomes more complicated, we add more individual magnets to approximate it. A Halbach array is an excellent example. The theoretically desirable magnetization vector changes continuously through the array. Conventional manufacturing approximates that field using multiple individual magnets, each with a prescribed magnetization direction.

More segments improve the approximation, but it is still an approximation.

What if the magnet itself could instead be manufactured with a continuously changing anisotropic orientation? Injection-molded anisotropic permanent magnets give us the ability to approach the problem from the opposite direction. Instead of asking, "What magnet can we fit into this rotor?" start by asking, "What magnetic geometry and particle orientation produce the field we actually want?" Then, a carefully designed bit of tooling is developed along with molding processes to manufacture the magnet. This creates an entirely different design space. This is not new technology. Yet, as we have continued to pursue that "next best magnet material", we often ignore what we already know. Over time this common practice has lost its luster for high tech applications. It's time to renew our interest in this manufacturing practice.

Maybe the next major advance in permanent-magnet motors will not come solely from discovering a stronger magnetic material. Maybe part of the breakthrough will come from removing the magnet as one of the primary design constraints.

What motor could we build if conventional magnet manufacturing were no longer one of those constraints? To reach this conclusion - Think Magnets First.

#PermanentMagnets #ElectricMotors #MotorDesign #Magnetics #SmFeN #Engineering #AdvancedManufacturing #Tengam

Part 2 of 4 - STOP COMPARING SmFeN TO NdFeB ONE CUBIC CENTIMETER AT A TIME

Part 3 of 4 - WE MODELED IT. HERE'S WHAT HAPPENED

Part 4 of 4 - FROM MANUFACTURING MAGNETS TO MANUFACTURING MAGNETIC FIELDS

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