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What Semiconductor Shortage Means For Patent Drafting

By **Darren Smith and David Ben-Meir** (June 7, 2021, 5:30 PM EDT)

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Nothing sparks demand like insufficient supply. The ongoing pandemic has caused or exacerbated numerous product shortages with some, like toilet paper, easier to remedy than others.

One critical shortage, however — which was developing long before recent events — concerns the global supply of integrated circuits, also called semiconductor devices. Semiconductor devices are among the hottest of commodities, and, as a result of many demand-side and supply-side factors, they have become difficult to obtain.

The problem is already causing a rethink within numerous economic and business spheres. One area in which it has yet to be considered but should be is patent protection.

Consumer devices enabled by semiconductor devices like processors and memory have exploded in number over the last two decades. Semiconductor device manufacturing is a highly complex and intricate process of arranging millions of nanoscopic components in a space measured in square millimeters in which as many as two out of three manufactured devices are unusable.

Manufacturing is performed in fabrication facilities called fabs. Bringing a new fab online can take years and cost upward of $20 billion. In the past, companies designed and manufactured the semiconductor devices themselves.

Over the last 20 years, however, companies have trended toward being fabless, whereby they design the devices but then contract with a fab to manufacture semiconductors according to the design. This fabless trend shifted semiconductor manufacturing out of the U.S. The U.S. share of semiconductor manufacturing capacity, which was 37% back in 1990, dropped to 12% in 2018.

The shift toward overseas manufacturing has made patent enforcement more difficult and challenged practitioners to advance claims that realistically can be enforced. In non-U.S. jurisdictions, bringing a lawsuit means much more limited discovery tools than the U.S., if discovery exists at all.

In the U.S., patent law offers a narrow path to enforce patents against semiconductor manufacturing

implemented overseas. The patent infringement statute, Title 35 of the U.S. Code, Section 271(a), generally limits infringement to activities like making, using, selling and importing that occur in the U.S.

But the statute also contains a provision in Section 271(g) that captures some overseas infringing activities by defining infringement to also include importing into the U.S. a product made by a process patented in the U.S. Under this provision, performing a semiconductor manufacturing process overseas in violation of a U.S. patent creates liability in the U.S. when the manufactured semiconductor device is imported to the U.S.

Nevertheless, use of this provision has its practical challenges. Some semiconductor processes have been suitable for enforcement under Section 271(g), such as when the process involves deposition and patterning of a sequence of layers creating a product that clearly indicates the sequence of process steps used in forming the layers.

Other semiconductor processes, however, are difficult, if not impossible to demonstrate from the resulting product, such as when the process involves how particular layers are formed or etched. The latter involves process details that often cannot be deciphered from the resulting product and instead may benefit from the broader discovery available in the U.S., except the documents sought are usually not available in the U.S. when the fab is located elsewhere.

Such challenges to enforcing U.S. patents under Section 271(g) have over time decreased interest in U.S. patents directed to semiconductor manufacturing processes and instead have led patentees to direct patent claims to end-products or to forego U.S. patent protection altogether.

The erosion of U.S.-based fab capacity is likely about to change. Lack of local fab capacity and increasing disruptions in global shipments, due to the pandemic, port backlog and other transportation issues, along with a trend toward just-in-time inventory management, have created a shortage of semiconductor devices in many industries.

At the same time, semiconductor devices are now used in an increasingly diverse range of products and industries beyond personal computers and smartphones. They include, among other things, large server centers powering cloud computing services that require packing thousands of processors into rooms and smart light switches that incorporate processors for wireless connectivity.

Even today's cars include dozens of integrated circuits to power new features like collision detection, app-based entertainment systems, digital instrument clusters, assisted driving and more. In 2021, automakers are being forced to remove features from new vehicles or shut down entire assembly lines due to semiconductor shortages. This higher level of demand — coupled with a lack of supply — has changed the thinking in the U.S. and Europe about reliance on foreign fabs.

There is also a growing national security interest in having more U.S.-based fab capacity. This convergence of priorities has resulted in acute interest in expanding U.S. capacity for semiconductor manufacturing, reflected by recent public commitments from private companies to build new fabs in the U.S. and proposals from government entities to encourage investment in local fabs.

Expectations of increasing U.S. semiconductor manufacturing capacity should be considered as patent practitioners advise clients on patent-filing strategy and refine and mine patent portfolios. An increase in U.S. capacity suggests a greater potential to enforce patents under the most commonly applicable

infringement provision, Section 271(a), and access to broader discovery tools in the U.S. regarding potentially infringing processes and tools.

In addition to investing in more robust U.S. patent portfolios, owners of semiconductor-related intellectual property should consider directing more patent claims to manufacturing processes, manufacturing tools and intermediate structures, and take other steps to better position a portfolio of semiconductor patents for enforcement or deterrence.

For example, intermediate structures, such as those that may exist on the wafer prior to dicing and packaging may have more value in U.S. patents if those wafers are made in the U.S., as compared to when the wafers are made abroad and the intermediate structure eliminated before U.S. importation.

U.S. discovery may provide the scope needed to obtain infringement evidence of such structures, although there is still the burden imposed by the 2007 Bell Atlantic Corp. v. Twombly and 2009 Ashcroft v. Iqbal U.S. Supreme Court cases to demonstrate infringement in the complaint.

IP practitioners revisiting claiming strategies for reasons discussed above should also keep in mind some recent case law affecting U.S. patent enforcement and appropriately steer portfolios in view of it.

For example, under Section 271(g), there is no requirement that a single actor perform all of the steps in a claimed process. As the U.S. Court of Appeals for the Federal Circuit held in 2019 in Syngenta Crop Protection LLC v. Willowood LLC,[1] the focus of Section 271(g) is only on products resulting from the patented process. That is, the act creating liability under Section 271(g) is the import of the product manufactured by the patented process, not the process itself.

The Federal Circuit noted that in Syngenta that "[n]othing in [Section 271(g)] suggests that liability arises from practicing the patented process abroad." Practitioners seeking to capture products of semiconductor manufacturing performed overseas under Section 271(g) understandably may have been less concerned about whether one actor performed all process steps.

That concern must be front and center for semiconductor products manufactured in the U.S. The Federal Circuit in 2015 in Akamai Technologies Inc. v. Limelight Networks Inc.[2] required that all steps of a claimed process be performed in the U.S. by or in a manner attributable to a single entity for infringement under Section 271(a). That is, divided infringement, and thus lack of liability, under Akamai may result when multiple actors are involved in performing all steps of a claimed method.

In Akamai, the invention involved content delivery networks, in which the claimed method included steps performed by different actors, namely the network operator and the customer. Although Akamai held that there were two types of arrangements in which liability could still attach, stronger and more readily enforceable claims under Section 271(a) are tailored to a single actor practicing all steps of a method claim.

With the anticipated heightened interest in semiconductor manufacturing method claims, the IP practitioner should seek to draft single-actor method claims with fab-line processing flow in mind.

For innovations focused on individual layers or structures, IP practitioners should draft claims focused on actions performed by a single tool or a cluster of tools working together to perform a particular function. For innovations focused on higher-level processing flows, claims should be focused on the context of the innovation within the front-end-of-line processing, back-end-of-line processing or

packaging.

In short, because of the differences between Section 271(a) and Section 271(g), IP practitioners drafting manufacturing-focused claims should address the possibility of different tools and actors involved in the process and attempt to keep one tool or one actor in view.

IP practitioners should also recognize that Section 271(g) excludes from infringement a product manufactured overseas by a process patented in the U.S. if the product is materially changed before import. Accordingly, liability will not attach under Section 271(g) to a product of a process covered by a U.S. patent that is materially changed from the product that is actually imported, even if the patented process was used to make the imported product.

The Federal Circuit in the 1996 Eli Lilly & Co. v. American Cyanamid Co. decision noted that the "materially changed" exception in certain circumstances "den[ies] protection to holders of process patents on intermediates as opposed to 'final' products."[3] Claims and inventions related to these intermediates can be significantly disfavored in a patent portfolio intended to cover products manufactured overseas.

The "materially changed" exception has never been definitively defined, and as the Federal Circuit held in the 2009 Amgen Inc. v. F. Hoffman-La Roche Ltd. decision: "[w]hat makes a variation significant enough to be a 'material change'" remains "a question of degree."[4]

In 1996, the Federal Circuit in Bio-Technology General Corp. v. Genentech Inc. intentionally avoided a definition noting that "Congress [apparently] wanted the courts to resolve this critical question of proximity to the product of the patented process on a case-by-case basis."[5]

However, this exception has remained a possible defense and thus a deterrent to enforcing claims to intermediate structures. Section 271(a), however, includes no such exception, and so making, using or selling a claimed intermediate structure may risk patent infringement liability because the proximity of the process to the product is not relevant when the process is performed in the U.S.

Thus, IP practitioners should consider claims to intermediate structures that add to the value of the final product, even if that intermediate structure is materially changed during later processing steps.

Related to this intermediate structure aspect is processes for testing, measuring and monitoring in semiconductor fabs, which may sometimes make use of intermediate test structures. The Federal Circuit has held in the 2003 Bayer AG v. Housey Pharmaceuticals Inc. decision regarding Section 271(g) that "by" in the statute's language "made by a process" requires that the process "must be used directly in the manufacture of the product, and not merely as a predicate process."[6]

In Bayer, processes involved in identifying a drug product for manufacturing through claimed research processes were not deemed to be sufficient to attach liability for the manufacturing of the drug identified through the claimed research processes. Patented methods involving, for example, obtaining and processing metrology data for semiconductor wafers during the more than 500 processing steps involved in making a computer processor product would arguably not be covered by Section 271(g) because the steps relating to measuring and processing the data are not directly involved in the making of the product.

By contrast, liability under Section 271(a) is not predicated on the manufacturing of the product but

rather on performing the claimed process. IP practitioners should seek to apply a more scrutinous eye to the measurement and testing aspects of semiconductor manufacturing and to claiming those aspects deemed inventive.

Rebuilding U.S.-based fab capacity will be a multiyear process, but now is the time to think about how to align patent portfolio development programs to a global semiconductor industry that may soon undergo major geographic shifts.

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[1] Syngenta Crop Protection, LLC v. Willowood LLC, et al, 944 F.3d 1344, 1360 (Fed. Cir. 2019).

[2] Akamai Technologies, Inc., v Limelight Networks, Inc., 797 F.3d 1020, 1022 (Fed. Cir. 2015).

[3] Eli Lilly and Co. v. Am. Cyanamid Co., 82 F.3d 1568, 1581 (Fed. Cir. 1996).

[4] Amgen Inc. v. F. Hoffman-La Roche Ltd., 580 F.3d 1340, 1379 (Fed. Cir. 2009).

[5] Bio-Tech. Gen. Corp. v. Genentech, Inc., 80 F.3d 1553, 1561 (Fed. Cir. 1996).

[6] Bayer AG v. Housey Pharms., 340 F.3d 1367, 1378 (Fed. Cir. 2003).