

INTELLECTUAL PROPERTY CREATION FROM SEMICONDUCTOR PROCESS AND EQUIPMENT DEVELOPMENT

K. Mautz
Motorola, Semiconductor Products Sector
7700 West Parmer Lane
Austin, TX 78729

Introduction

Process development, such as in plasma etch recipe modification, is increasingly being influenced by intellectual property factors. Development examples include new plasma chemistries from unique etchant gas combinations, endpoint detection or process control methods, and novel applications of these processes to produce new device structures. The choice to seek protection from a patent presents the technologist or engineer with a new set of challenges.

Experimental

Typically, new concept process tools are delivered with start-up recipes developed within the supplier's labs or co-developed with an end-user of the tool. During introduction into the end-user's manufacturing areas or research labs, the recipes are further characterized and parameters adjusted to optimize the process for specific uses. Often, this leads to unique and novel recipe parameter factors that can be considered for intellectual property creation.

Results and Discussion

Intellectual property (IP) consists of trademarks, patents, and copyrights. Of these, patents are of the most interest to Process development engineers and technologists. Patents can prevent others from making, using, selling, importing or offering for sale products or materials, including those that are made by specific processes, that are covered by a patent. The basic requirements for patenting are uniqueness and novelty, usefulness, and difference from the prior art (what is known or how it is presently done). Strategically, patents can have a defensive value by protecting technologies or products, or an offensive value by obtaining royalties and licensing fees for use of the technology.

Increasingly, companies are focusing on IP awareness and generation activities. IP awareness includes meeting with innovators, groups or departments to present IP concepts or discuss potential innovations and patenting topics. Resources and tools are identified to energize and motivate employees to disclose innovations and improvements, or to conduct patent and literature searches. IP generation includes obtaining disclosures especially in areas targeted for protection, and reviewing these through a committee of technology experts and patent agents to select those that are advantageous for filing. When selecting an identified innovation for patenting, the aspects considered are: 1) impact to the business, 2) technology improvement, 3) potential use by others (licensing), and 4) effect on industry standards.

There are many and diverse reasons or motivations to innovate. Technologists in semiconductor manufacturing have the opportunity to work and contribute on many leading edge, rapidly developing, or disruptive (replacing the currently accepted) technologies. Examples of technologies that are currently being developed and targeted for patent protection are: 1) process sensors and endpointing

techniques, 2) real-time control methods, 3) *in situ* metrology techniques, and 4) process improvements for yield impact or tool cost of ownership improvement. All of these areas are ripe for innovation and improvement. The key points to be addressed in the innovation development process include: 1) what is the problem to be solved, 2) what is the prior art, 3) how does this idea resolve the problem in a new way, 4) what are the benefits, and 5) how would it be used, or incorporated in a process or product. An innovation can be the outcome of a successful technical project or problem-solving team that created an improvement in a processing scheme or product functionality.

Defensive publications are another form of IP that can be used to protect innovations by preventing competitors from obtaining patent protection. These, when published, establish prior art and are typically used to ensure free use of the technology and prevent competitors from obtaining patent protection in similar or related areas.

Companies that manufacture commodity device products using similar process tools (from a limited choice of suppliers) seek to differentiate themselves from their competition by developing patentable processes and procedures. Patents can be used to secure freedom of action in emerging technologies, expand into new markets, and inhibit the success or aggressiveness of competitors.

Software tools are increasingly being used to assess a potential patent's value both offensively and defensively, and to determine the active participants in the technology space. This analysis can include an assessment of a patent portfolio, the patents that affect the marketplace, financial strength (of a developer), and competitive intelligence of patent activity worldwide to evaluate research directions. This information can be shared among engineers and technology managers to provide knowledge of likely developers and potential risks in obtaining patent protection in a given technology space. These software systems can routinely or periodically gather available data, analyze for relevant information, determine potential risk or highlight recent activity changes, predict outcomes and recommend new actions, and provide feedback to assess potential problems. This data can be actively managed for many diverse technologies and product cycles or development stages. The critical information provided includes how fast the technology is evolving and which competitors are developing leading edge technology or following the trend as imitators. This data can enable good business decisions by objectively analyzing and benchmarking a company and their competitors.

Conclusion

Increasingly, companies and organizations are encouraging their research and development labs or manufacturing areas to investigate the possibility of converting new concepts or ideas into IP.

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References

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