

[Taiwan's Green Technology Related Semiconductor Patent Applications]

The intellectual property system encourages innovation, research and development, but with the rapid development of high technology, global warming is becoming more extreme. In Taiwan, semiconductors are an important technology industry that gathering many domestic and foreign technology companies. It has a complete industrial chain from the upstream of IC design, the mid-stream of manufacturing, and to the downstream of packaging and testing. However, the semiconductor industry consumes not only water and electricity, but uses large amounts of gases and chemicals in the cleaning operations during the manufacturing process, thereby generating waste gas and waste liquid. These wastes will cause environmental pollution if they are not properly treated. The global enterprise RE100 (Renewal Energy 100) initiated by the United Nations under the promotion of net-zero carbon reduction is moving towards the goal of 100% renewable energy, and the world largest wafer foundry, TSMC is the first semiconductor industry to join RE100. For the international Semiconductor Climate Consortium (SCC) established in November 2022, it has several founding members from Taiwanese companies including TSMC, ASE, Global Wafers, Hermex Epitek, and Nanya Technology. By adhering to the enterprise net-zero and sustainable business philosophy, TSMC has cooperated with relevant manufacturers to develop energy-saving semiconductor machines and improve the recycling of resources, in order to reduce operation costs and climate risks.

In this regard, the Taiwan Intellectual Property Office (TIPO) aims to provide information and patent layout for semiconductor enterprises in the transformation of green manufacturing. TIPO has referred to WIPO's International Patent Classification of 2010 IPC Green Inventory (divided into seven categories including alternative energy, waste management, etc.) and the Japanese Green Transformation Catalog (GXTI), with the 4R principles of Reduce (energy saving, reduction), Reuse, Recycle and Redesign/Regeneration, to compile the IPC classification numbers that have higher relevance for semiconductor green manufacturing/machine patent cases. The following summary table serves as a reference tool for patent searches.

Description	IPC classification numbers
Equipment suitable for converting radiant energy into electrical energy	H01L 27/142, 31/00-31/078, H01G 9/20, H02S 10/100
Silicon, single crystal growth	C01B 33/02, C23C 14/14, 16/24, C30B29/06
Treatment of water, waste water or sewage	C02F 1/16
Waste disposal	B09B, B65F

Recycling or processing waste materials	C08J 11/00-11/28, C09K 11/01, C11B 11/00, 13/00-13/04, C14C 3/32, C21B 3/04, C25C 1/00, D 01F 13/00-13 /04
Recovery of metal from waste materials	C22B 7/00-7/04, 19/30, 25/06
Treating waste water or sewage	B63J 4/00, C02F

Furthermore, TIPO has focused the patent applicants on TSMC's supply chain manufacturers and R&D institutions, and also conducted interviews with the related companies regarding the current situation of green manufacturing in the semiconductor industry. TIPO specially selects ten big tech companies from these semiconductor equipment and raw material suppliers, including Applied Materials, Hermes Epitex, Trusval Tech, Solar Applied Materials, Global Wafers, Shin-Etsu, ASML, Tokyo Electron, ITRI, and Canon. By retrieving and analyzing thousands of the publication and laid-open patent cases in the field of semiconductor technology from 2016 to 2022, TIPO has sorted out 116 patent cases of semiconductor green manufacturing/machine-related technologies. These cases include technologies such as chemical-mechanical polishing (CMP), wafer prober testing and inspection, vapor phase film formation device, waste liquid extraction and recycle, chemical liquid dilution, regenerated sputtering targets, silicon wafer furnace (CZ Method), EUV lithography equipment, etc., which can serve as the reference cases of green manufacturing transformation for semiconductor enterprises.

Additionally, due to the rapid technological progress and the importance of innovation on competitiveness, it may be necessary to obtain patent protection as soon as possible for an invention application relating to semiconductor green technology. The Applicant can file a request for accelerated examination per Ground 4 for "green technology" under Accelerated Examination Program (AEP) by submitting the relevant evidences or explanatory documents. TIPO will issue an examination result within six months upon filing of the required documents. Per the AEP statistics by TIPO, there were 223 AEP applications based on Ground 4 from 2014 to September 2022, in which 155 applications were approved and 68 applications were rejected. The approval rate is nearly 70%.

