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Proposal of Semiconductor Devices

Yasushi Watanabe (1896–1976) was a pioneer of electronic engineering in Japan and promoted research in the earliest stages of the study of semiconductor devices. The invention of the pin diode and the ion implantation method in 1950, which was carried out together with Junichi Nishizawa, the discovery of the fact that the rectification phenomenon occurred by creating a thin layer with high resistance, and the hot electron theory were noteworthy achievements in the early stages. In addition, electrostatic induction devices and pin photodiode devices derived from the discovery of the pin rectification phenomenon and APD were pioneering studies on photonics. After this, significant contributions were achieved by them for many years to promote studies on semiconductor devices, and in 1970, Y. Watanabe was selected as a cultural contributor and in 1989, J. Nishizawa was selected as a recipient of the Order of Culture.

APD: Avalanche Photo Diode

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Anode Split Magnetrons

Kinjiro Okabe (1896–1984) invented the split-anode-magnetron using magnetron as a practical microwave oscillation source, which is currently used for microwave ovens and radars. He taught as a professor at Osaka imperial university, and Kinki University, etc., and then received the Order of Culture.

In 1925, after a short time when he was newly assigned as an assistant professor at Tohoku imperial university, when he was conducting experiments with students using a singular-anode-magnetron which was proposed by Albert Hull at GE in the United States as an amplifying tube for low-frequency wave, he noticed the fact that the relationship between applied magnetic field H and anode current I was mismatched with the theoretical value, and thereby discovered the fact that some kind of oscillation phenomenon occurred.

Then in 1927, he found the fact that a device made in steps—splitting the cylindrical anode in the axial direction, then building a oscillation circuit between them—was able to effectively and stably oscillate microwaves (back in those days, wave length: 3 cm, frequency: 10GHz). This finding marked the beginning of the discovery of the multi-split-anode magnetron. In other words, the electron emitted from the cathode did not directly reach the cathode, but drawing a cycloidal curve due to the magnetic field applied in the axial direction, it moved making circuit movement in the space between the cathode and

the anode while the frequency element oscillating with it was efficiently output.
This discovery received attention as a remarkable study from home and abroad, because at that point, the shortest oscillation wavelength (the highest frequency) was a wavelength of 24 cm and a frequency 1.25GHz made with Barkhausen－Kurtz oscillation vacuum tubes and published in Germany.