

1980's

Formation of Deep Well by High Energy Ion Implantation

Process Technology ~

In the 1980s, ion implantation equipment technology developed, and high energy implanters which served for practical industrial use were released. IX-1500 released from Genus was a tandem type machine with a terminal voltage of 750 keV maximum, and could accelerate trivalent ions to 3.2 MeV. Also, in the 1990s, Sumitomo Eaton-Nova (currently Sumitomo Ion Technology Co., Ltd.) used a RF linear acceleration mechanism for a high energy implanter with a reliable wafer processing function which could accelerate monovalent ions to 1 MeV and trivalent phosphorus to 3 MeV.

High energy implantation was initially adopted for twin well formation of DRAM and was further applied to the formation of triple well with deep well. By adopting the twin well structure, it became possible to avoid latch-up which easily occurred in the same pnpn arrangement as the thyristor. In the deep well structure, the substrate bias can be changed for each circuit block, thus controlling V_{th} , and various performance improvements can be realized such as reduction of noise and influence of soft error due to alpha particles and so on.

These high energy implantation machines are now indispensable for forming deep photodiodes of image sensors, and they contribute greatly to the improvement of photosensitivity.

Figure: Triple Well Structure

