

1990s

Establishment on supply chain for CMP system and materials

~ Discrete Semiconductor/Others ~

CMP (Chemical Mechanical Polishing) technology is one of the surface planarization technologies. Practical use had progressed mainly by IBM since the latter half of the 1980s. Unlike the conventional planarization such as reflow and etch back, it had an advantage that polishing process could make the wafer surface almost completely flat.

This made it possible to put into practical use completely new process modules such as STI (Shallow Trench Isolation) and damascene Cu interconnects. In particular, it was largely due to the adoption of damascene technology when copper, which was difficult to process by dry etching, was put into practical use as wiring. In addition, planarization by CMP became a savior for a narrowing depth-of-focus margin in lithography lens and greatly contributed to the acceleration of miniaturization of VLSI patterns.

Planarization by CMP was performed by pressing the wafer downward on a large table covered with a polishing pad and revolving and rotating wafers while supplying abrasives. In this method, a higher pressure was applied to the convex portion than to the concave portion of the wafer. The pressure dependence of the polishing speed created difference of the polishing speed between the convex portion and the concave portion, which made the polished surface planar.

Initially, American equipment such as those made by Westech was the mainstream. It was often installed in a separated CMP room due to problems such as dust generation from abrasives. FBARA developed an all-in-one type CMP system that added a post-cleaning chamber in the early 90's. Because it was able to install this system in a clean room, it made it easier to install the CMP system into semiconductor production line. AMAT developed a CMP system equipped with a polishing end point detection function in the late 1990s, making the CMP even more practical.

In addition to equipment, expendable supplies such as abrasives and polishing pads, which greatly affect process performance, were extremely important in CMP. Most abrasives were made by dispersing fine silica particles in water and adding agents to promote and control polishing. Foamed polyurethane was often used as the polishing pads. Initially, the most common products were made by Cabot (abrasives) and Rodel (polishing pad) in the U.S. Recently, JSR (abrasives and polishing cloths), Hitachi Chemical (abrasives), FUJIMI (abrasives), and others had begun supplying high-performance expendable supplies, and made the presence of Japanese semiconductor material manufacturers.

Particle residue and scratching (polishing scratches) had been problems since the early stage of development of CMP technology, but had been overcome by post-cleaning and optimization of abrasives. For post-cleaning, scrubbing with a PVA (polyvinyl alcohol) sponge was widely used, and if necessary, a cleaning with chemical solution was used together. As the progress of miniaturization of VLSIs, CMP had become an even more important technology now and in the future and intensive development activities had been continued..

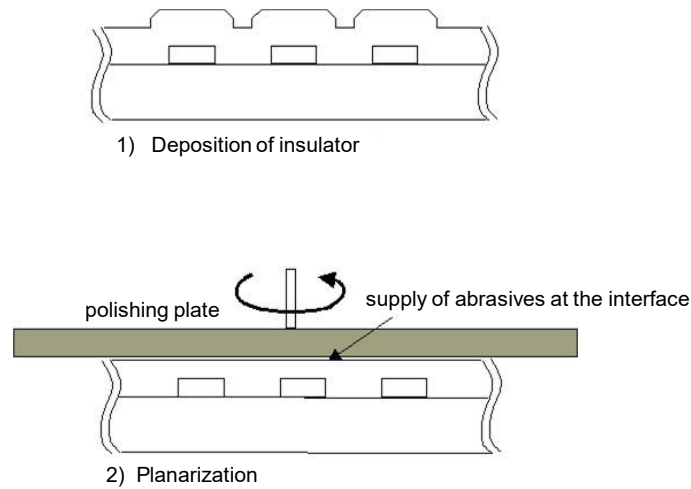


Figure 1 Planarization by CMP



Figure 2 Dry-in/dry-out CMP system (EPO-1141)
(Courtesy of EBARA CORPORATION)